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The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS

AM. SOC. ENGINEERING CONTRACTORS 1909

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Volume I—No. 1
OCTOBER, 1913

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1395-04
20/9/16.

Address all correspondence in regard to Advertising and Subscriptions to R. M. HOOKER, Business Manager, *The Engineering Contractor,* 168 Duane Street, New York City, N. Y.

Published Monthly at the Rooms of the *American Society of Engineering Contractors,* 11 Broadway, New York City, N. Y.

Entered according to Act of Congress, by the American Society of Engineering Contractors in the Office of the Librarian of Congress, at Washington, D. C.

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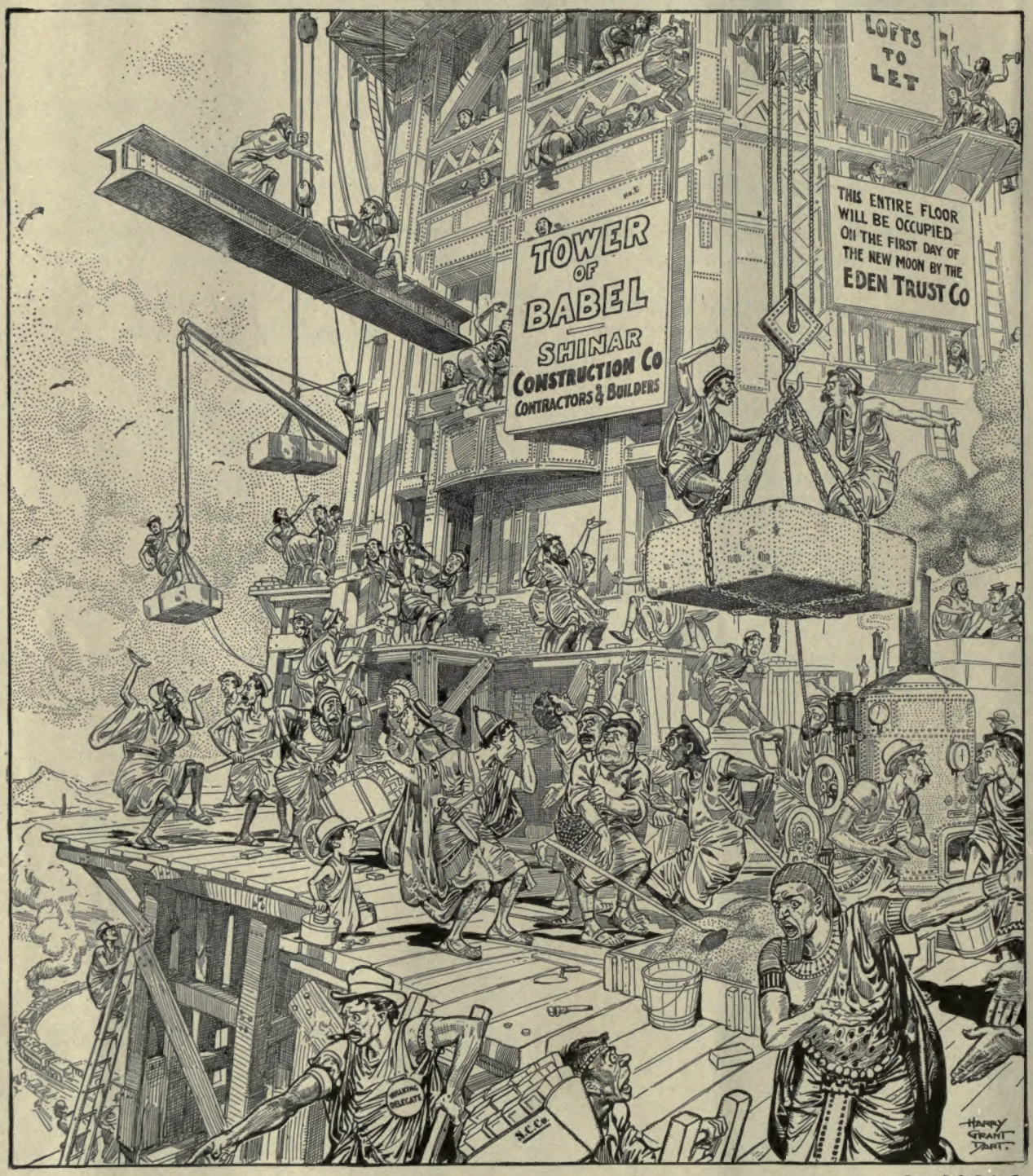
At a meeting of the Board of Direction of the American Society of Engineering Contractors, it was voted, that *The Engineering Contractor*, shall be the official means of communication with members of the Society and that all notices heretofore sent out in circular form will be inserted therein, and shall be considered as legal notification, except in case of emergencies.



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History as it Might Have Been

THE CONFUSION OF TONGUES

See Page 14

THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS

Volume 1 NEW YORK, OCTOBER, 1913 Number 1

Object, Policy, and Scope of The Engineering Contractor

Beginning with this issue the American Society of Engineering Contractors, Inc., presents its publication under a new name and in a changed and amplified form. It will be seen that the size, appearance and make-up, bear no resemblance to the former *Journal.*

For some time past, the Board of Directors of the Society realized the importance of an enlarged publication wherein the activities of the Society might be set forth in greater detail and, yet, compactly, so that the hurried reader could absorb the same readily. At the same time, their object was to adopt some distinctive cover design that would impress the prospective member favorably and induce him, as well as the active member, to read the contents of the magazine. There is no denying that, in order to create interest in anything, the first impression of it must be good.

It was not without some tremor that the old and tried *Journal* was vivisected, so to speak, to learn whether a blending of the separated elements together with new ones would not result in an entirely novel and useful creation. We confidently believe that this was accomplished.

The Society was not organized simply for the purpose of extracting a consideration from men interested in Engineering and Contracting in exchange for the privilege of being members. It was created for some very specific reasons and to realize some decidedly material improvements in the conditions and situations of the men who make up its membership.

To achieve those aims two things are vital: First, strength of numbers; second, a vigorous and active organ wherein the objects for which the association exists may be fully explained and the advantages derived from their accomplishment demonstrated, thus securing definite results.

Membership, because of human inertia, grows slowly. The majority of men would rather be on the side lines watching the fight than to mix in it, especially if they are not convinced that their personal interests are involved. But if the fight is won and they believe that to side with the victor is of some special benefit to them, you will have to turn away a good many of them for lack of room.

Fortunately, the second objective may be realized more quickly through the exertions of the small number of very busy men who form a group which, in all organizations created for the benefit of the many, do a work that, necessarily, will be a labor of love during the first few years of any Club's or Society's existence.

Granting the foregoing, how can we build up a strong and influential organ?

To this question, we find an answer when we look around at the publications and magazines, technical and non-technical, that are for sale on public stands.

In the first place, assuming that we are simply looking for something to read, we are attracted to the publication that has a neat and artistic cover. Then if a casual inspection of the contents judged from their titles indicates matter of interest, we purchase the book.

Right there and then, the publisher has gained his most important point, i. e., he has created a desire to read his publication. Then if the actual contents measure up to the reader's first impression, the latter has derived pleasure in the reading, and a permanent and positive effect has been produced.

In the publication of technical or trade papers, there is much room for the adoption of the methods of the best magazines and newspapers.

Stories of technical experts should be re-written by some one who can put human interest in their stories. Even catchy headlines may be used to great effect, and other special features may be adopted, so long as their aim is to produce a better paper. In other words, as stated by Mr. Waldo, before the Federation of Trade Press Associations:

> "Make the Trade Press readable—readable to 95 men out of every 100 in their specific trades —and you will make it a greater power than magazines, newspapers and house organs combined. Make the average man turn to his own Trade Paper with one-half the pleasure with which he now turns to the *Saturday Evening Post,* and you will build properties powerful beyond your present dreams. Do not say that it cannot be done—for it can and will be done if I have to start and do it myself."

The moment a technical publication satisfies the above mentioned requirement and, at the same time, maintains the Trade Press' high standard of reliability, there is nothing that it may not accomplish so long as that thing will be of benefit to the specific trade it represents.

Therefore, all the changes in the present publication were adopted to make it attractive, readable, unique, and, above all, influential.

The first step in the process of improvement was to select a title that would indicate the character of the membership of the Society and which, at the same time, would be brief, snappy, neat, and easy of reference. The present name was picked out of several that had been suggested and it is believed that the choice will be approved by our readers.

The Engineering Contractor will contain as little as possible of the matter that may be found in other technical papers. No strictly scientific or theoretical technical articles, no historical or general engineering essays, will be printed therein. In other words, no attempt will be made to add to the enormous amount of material of this kind found in older publications that are better able to gather and disseminate the same.

On the other hand, prominence will be given to articles, discussions, and news relating to specifications, costs, methods, management, and to the legal and business end of contract work.

Space does not permit a more complete enumeration of the features which we propose to include in *The Engineering Contractor,* but further details will be given in the next issue.

Is Scientific Management a Failure?

These are days of wonderful mechanical development. We see a constantly increasing application of ingenious machines to the making of many things that, formerly, were made less economically and not quite so well by human hands. Hence, one is apt to overlook the fact that there is still an immense amount of work that must be done by manual labor, especially in construction work.

This fact, however, will be readily appreciated by contractors, for they know that, usually, more than half the total cost of any job is pay roll. Labor cost is always the largest single item of expense on contract work.

Therefore, is it not astonishing that while technical literature is teeming with illustrations and descriptions of new machines for mixing concrete, drilling rock, excavating earth, and for doing the numerous other things that have to be done on contract work, so little is published regarding the handling and management of the most important machine of them all, i. e., Man, on the same kind of work?

Much is being said and printed about efficiency engineering, scientific management, motion study, etc., and remarkable results have been accomplished thereby. Although the principles of these sciences are of comparatively recent application they already have remarkable achievements to their credit. New sciences are the result of deep and persistent observations and experiments made with machines inanimate or animate. We say animate machines, because the observations and experiments made with human beings were made exactly in the same way as they are made with machinery when it is desired to improve the same.

Motions were studied with a view to economizing effort and, therefore, increasing the output of men; ways and means were devised to get to and from them with the minimum friction and in the least possible time, the things they need to handle to produce certain definite results.

Of course, the application of the principles of scientific management to men differs from their application to machines. in that the former are encouraged to increased performance by the assurance of increased reward. In other words, payments for work are to be proportionate for the work done. Otherwise, the analogy is complete.

The handling of human nature, therefore, has not yet been reduced to a science and, perhaps, may never be. There are many things, nevertheless, that are known and that may be taught by men who have had much experience and who have been successful in the management of men.

For that reason, we are particularly gratified at our having the privilege to publish in this issue Mr. Hollingsworth's paper on "Human Nature on Construction Work." There is, unfortunately, little in print to compare with this essay (we were almost going to say, treatise), but, anyway, it is easily by far the best, the most complete and instructive writing on the subject, that we have read, and will probably remain so for some time to come. Furthermore, it is adorned with anecdote and humor that make it far more entertaining reading than most technical articles of the same kind.

It has been claimed that little is published about the subject because it is difficult to impart the knowledge thus acquired. Perhaps, so. Still, after reading Mr. Hollingsworth's contribution, we are of the opinion that he successfully accomplished this feat.

It is interesting to note the divergence between some of the views of the author and those expressed by efficiency experts. Taylor in his book on "The Principles of Scientific Management," writes that to have work done according to scientific laws, we should eliminate all false movements, slow movements, and useless movements through a series of experiments with a stop-watch to determine the time required to make each of the elementary movements, from which the quickest way of doing the work is selected.

Mr. Hollingsworth, on the other hand, believes that, in the first place, the motions which may be determined scientifically to be the most effective may be physically impossible to certain men. He believes, furthermore, that by elimination and substitution, ten medium good men working in their own way will do a deal more work than nine men, however good, trying to work in an unnatural manner, and one man working in his natural manner.

He believes that what may appear at times to be the hardest method of doing a task is very often indeed the quickest. It is not the motions a man goes through with his hands that count, but the motions he goes through with his brains. He sums up the subject by saying that "team work is the whole proposition."

This is an interesting conclusion which the author proves by actual examples. To a general extent this principle is endorsed by Gillette and Dana in their book on Cost-Keeping and Management Engineering. They give ten laws of management among which is the law of co-ordination. This specifies that the performance of each gang on a certain piece of work must be so scheduled that the gangs will work in perfect co-ordination with other gangs on the same job. But then they say that this involves the working of each man to his capacity all the time, and necessitates not only the proper organization of the gangs, but also the prompt arrival of supplies and materials, and freedom from breakdowns.

As to the last proposition, Mr. Hollingsworth is thoroughly in accord, but he claims that the best results are obtained, not by working each man to his maximum capacity, but by keeping the gang going at top speed. In that case, each man has certain things to do and, at times, may slow down with his part of the work while at other times he must work at top speed to keep up with the gang.

It will be interesting to hear from efficiency experts after they have carefully studied Mr. Hollingsworth's paper. A full and competent discussion of the very important points raised by the author will be of unusual benefit to the manager of men.

When this paper was first submitted to us, our editorial censure was shocked at the generous amount of slang used to amplify the author's remarks and, in accordance with our established notions of literary propriety, we promptly proceeded to eradicate all the words not strictly according to Webster's.

Then with a proud feeling of having done our work well, we read the revised story. But somehow or other, it lacked the snap and ginger that was there originally. We received a nitric, pungent and racy narrative and when we got through with it, we had what Fra Elbertus would call a "bromide." We then realized that far too much of the construction job forcible, although perhaps inelegant, vernacular had been eliminated.

Thereupon, we promptly restored expressions and words which, although they may not yet be sanctioned by standard dictionaries, are well understood by those to whom the paper will appeal. After all, as stated by Prof. Hotchkiss of N. Y. University, "Of the three factors that enter into any message—the writer, the subject, and the reader—the reader is of paramount importance. It is not what you give but what he receives that counts."

The author's paper is not suitable for publication in the proceedings of the Ladies' Club for the study of Shakespeare's writings on Suffrage or for the Association for the Improvement of Speech on the East Side, but it will, we are sure, appeal to the members of the American Society of Engineering Contractors, who are men accustomed to the language heard among contractors. To them the paper will have a familiar sound and it will impress them far more than any formal and academic article would.

Aside from the foregoing it must be acknowledged that what may be slang to-day will be the accepted word tomorrow, and that, therefore, we may be making history. For, in the words of Prof. March: "If a language is to live it must be supplied with a constant inflow of new words, of which a vital part comes from the feeling and imagination of persons who express themselves in slang. A living language is a lake from which there is a constant flow of words to the ocean of oblivion, and which has a constant supply from the foundation of popular talk."

The author, who is a native of Nova Scotia, has been in charge of construction work in the United States, in Canada and in Mexico, amounting to several millions of dollars, and during his twenty-three years of experience has had ample opportunity to test his theories. He speaks authoritatively. His views will be of benefit to the Contractor as well as to the Superintendent and to the latter's subordinates. It will be valuable to the Engineer identified with, or in charge of, contracts, either as designer or executive. To the lower officials on this class of work, it will be an inspiration.

Human Nature on Construction Work

By C. H. HOLLINGSWORTH *

Member of Am. Soc. Eng. Contr.

To the layman, and even to some practical men, the business of Contracting presents a rugged aspect with more or less grim toil on the one hand, and dollars and cents, or the lack of them, on the other. Many of them think all this business requires is horse sense and experience, or engineering ability, or both. While these are very necessary attributes, however, the man who aims to be a successful contractor must have many very human qualities popularly supposed to be owned exclusively by members of other and more æsthetic and artistic lines of business.

A contractor must have sufficient imagination to be able to visualize his work completed when it has just started and to bend all things to that end. He must have a sense of humor, so that he may see the funny side of some of the people he has to deal with, thereby saving himself from nervous prostration; sentiment, to appreciate the dramas and tragedies which daily occur before his eyes; courage, to show the way where there are no battle flags flying or war correspondents to relate his exploits, to take his medicine in silence when things go wrong, and last but not least, honor, which means to give the party of the first part a square deal when in a position to easily profit by some undue advantage with no one the wiser.

The foregoing being granted, it must astonish many, as it did the writer, that papers dealing with construction problems, pass over so lightly this most important and vital item, i. e., the science of handling human nature on contract work.

The subject is so fascinating that I wish I could wield the pen of a Ruskin to discuss this problem, but since no one, heretofore, has seen fit to publish a study of the organism of the "mucker," the "sand hog," and the "rough neck," not to mention the "stiffs," "skinners," "long line skinners," and "swampers," therefore, I will endeavor to dissect their simple natures to see the wheels go around, although in extenuation of anything herein set down that is not according to parliamentary practice or is contrary to specifications, I must plead guilty of being handier with the shovel than with the pen. That the subject under discussion is of importance will be readily acknowledged by all Engineering Contractors; to others, it only needs to be pointed out that on construction contracts, the pay roll usually runs well over half the actual total cost, and that it is the largest single item of expense on the work.

Great improvements have been made in contractors' plants during the last twenty years, but very little progress has been made in the intricate art of getting work out of men. Some improvement has been made along this line, especially in the direction of increased efficiency in manufacturing establishments, but beyond a certain point, the improvers have failed to treat the improvees as live human beings, looking upon them more as machines to be placed here or pushed there or to be timed with a stop watch and card-indexed. Right here is where the learned improvers have jumped the track, so to speak.

To any one who takes the trouble to study the men on any construction job (and it pays to do so) it will soon become apparent that they are all very much alive and human. Therefore, if scientific men initiate any scheme of improvements or put into practice any theory without taking these humble toilers of the soil (or of the concrete board, as the case may be) into consideration, there is usually a wide and yawning gap between said theory and the actual practice.

The writer does not mean to imply that the contractor should take counsel of these more or less horny-handed (or headed) workmen before making any innovation, but he should rather figure them in before starting anything. Be it understood that the writer approaches the subject not from a utopian but from a utilitarian point of view, not as a student of sociology but as a seeker after dividends, and that by the same token there are more dividends to the square foot in this human nature proposition than in any other department of the contracting business.

Now, this is no easy problem, nor can the writer, after about twenty-four years' experience in engineering and contracting, point out any short cut to golden results. However, he will try to bring out those features of the subject that are of particular interest and that promise such results. Included in this problem are all men on the work, from the Superintendent down, and that gentleman will serve as a starting point.

The Superintendent.

There are nowadays, three general classes of superintendents. First, those who have worked up from the ranks with no knowledge of engineering except a smattering picked up as they go along; second, those with an engineering education, who have been engaged either as engineer-in-charge or assistant on construction work or as contractor's engineer, and who from such position have been appointed superintendent.

The above two classes of men are of about equal ability and neither has much advantage over the other. Each has something that the other lacks and each lacks something that the other has, and both lack something that is necessary to make a man a successful superintendent and leader of forces on construction work.

The third class of superintendents is not so numerous as either of the other two, but, fortunately, the men in this class are increasing, and they are without doubt the hope of the contracting business. They are men with engineering training, who, after coming out of college don overalls and start in at the bottom in contracting work, and work, fight, and elbow their way to the top. It is not such a long way either if the man has the ability. These men know both ends of the business and they make their influence felt.

It is contended that the graduate engineers, who make up the second class of superintendents above referred to, will acquire practical experience in time. Possibly so, but it is extremely doubtful. First, because a man after he gets along in life a bit, does not pick up things so rapidly as when younger, and second, because after he has risen in his profession, the chances are very much against his groping at the bottom of another profession or business in order to gain light on certain points.

Imagine, if you can, Mr. John Jones, C.E., B.Sc., etc., and Superintendent on the W. X. Y. tunnel, manfully swinging a striking hammer and perspiring profusely in an effort to hit a "bull point" held by one Pietro Spaghetti, at the same time dodging a drill and column on one side, the tunnel rib on the other, a "muck pile" at the bottom, and a low piece of ground on the roof, while a colored gentleman, misnamed George Washington, instructs him in the gentle art. To complete the scene, in the background are grouped Huns, Goths, Vandals, Polocks, and others from the "Limerick side of the Rhine." Ridiculous, surely and so is the idea that this practical knowledge can be and is, easily acquired.

It has been remarked that it is not necessary for a dignified superintendend to do these things. It certainly is necessary, not for him to do them but for him to know how to do them. A superintendent on a rock tunnel job ought to know how to use a striking hammer, cut and cap a fuse, load a hole, fire a heading by fuse or electric current, run a drill, scale down the roof, run an electric locomotive, drive a mule, and about one thousand and one other things. That looks like a "tall order" but it is not, it can be done.

On the other hand there is an equally foolish contention that the superintendent who has come up from the ranks can pick up all the engineering knowledge he needs. Possibly he will go on a vacation and take a post-graduate course at some engineering college or university or again, perhaps he will sit up nights to absorb a correspondence course in Civil Engineering, taken painlessly in homeopathic doses. The sad truth is that he does neither. He will often work his heart out day and night to keep things going but, there is no doubt about his engineering ability. He usually does not know whether the engineers set grades with a level, a sunflower, or a gramaphone, or whether a level rod is laid off in inches, tenths, hectares, or arpents, and he maintains that a tape with only ten inches to the foot is a fool thing. Neither does he know Trautwine's Pocket Book from the U. S. Pharmacopœia or from a copy of Kipling's poems. As stated in the other case, it is essential to know these things, if not to do them.

It has been intimated that the best superintendents are those engineering graduates who proceed to acquire practical experience. This way of doing business is common practice with a large number of electrical and mechanical engineering graduates, but the civil engineers do not take kindly to it, for they seem to view with suspicion the two-fisted men with one suspender and dirt on their overalls with which they have to associate. The writer knows of one man who even gave up the practice of civil engineering because he had to be on construction work and therefore come in contact with such uncouth men. On

* General Superintendent, Buffalo Dredging Co., Buffalo, N. Y.

the other hand, he knows of a great many hardy young college graduates who are in the thick of the flying dirt with the best of them. Included in this number is one young man I have in mind, who after leaving college put in about two years as rodman and transitman on construction work, but who is now on a large contract, where he worked first as pump man, then as concrete foreman, and finally became assistant superintendent. All of which happened in three years, which is advancing quite rapidly. That young man and a number of others like him deserve praise.

Outside of the superintendents in the three classes mentioned, there are a few scattered ones who arrived by various other routes. Some possibly were born that way, and some had it thrust upon them. In one case a man who had been bookkeeper for a contracting firm, was pressed into service to finish a small job. Feeling the sprouting of his wings he induced the company to continue employing him in the capacity of superintendent. This, however, is not what bridge engineers would call good practice, and in the case in point, the honest gentleman made a terrible mess of his subsequent work.

Before taking up another phase of the subject the writer wishes to disclaim any personal interest and to be dipped in an immunity bath by stating that he belongs to none of the classes mentioned, but to a class whose numbers are so small as to be neglected.

The next phase of the subject relating to the superintendent, is his ability to handle men and to get the maximum amount of work with the minimum amount of effort (to the men) and the minimum amount of friction. This ability, as a general thing, is born in a man and will show up when he first takes hold of work. In many cases it amounts to genius.

The gift must, however, be developed by a close study of human nature, and that is the reason why some men, apparently without any gift in that line, develop such ability in a few years as to deceive the casual observer into thinking that an ordinary man with no talent for management has been developed into a wonder by some astute superior. This is a mistaken idea, of course, as the man always had the genius latent in him and it was developed by training. If the man had not possessed the gift originally, no amount of training could have made him efficient, just the same as an artist cannot be made of a man with no inclination for art. In the nature of things, the man with the talent can not become proficient unless he has the training.

In dealing with the men a superintendent must first of all have their respect. Some of them will respect him for his ability to hand them a short arm jolt in the "sleep producing region," or his ability to pick up a four-hundred-pound weight, but these are in the minority. What the great bulk of the men will respect him for will be his knowledge of the details of the work, his ability to get things done, and his general clean living.

Strange as it may appear to some, the roughest and toughest men in the gang have a great admiration for the boss' clean morals and honesty, whatever their opinion may be of the same qualities in their companions. And let no superintendent think that his strayings from the narrow path, however trivial, can go unnoticed.

A construction job is the original gossip factory, and if some of the captains of industry, engineers, or contractors could hear the extremely forcible and truthful remarks about their habits and character, they would gasp for breath and possibly pause to reflect a bit. This propensity to gossip looks like a trivial thing, but it is not, and the only way to avoid it is to leave no opening for the men to discuss their superiors' shortcomings, and hence the advice to travel straight. Also they will be fair, and if they have nothing detrimental to talk about you, they will converse about the other side of your character with the result that they will grow quite enthusiastic over you. That result is worth a lot of money to the contractor.

As an illustration of this the writer some time ago assumed charge of a tunnel contract not a thousand miles from New York. The Contractor was one who prided himself of the fact that he knew most of the men on the work by their first names. He would arrive on the job periodically, make a great show of donning a blue flannel shirt, high laced boots and the rest of the costume appertaining to the matinee idol in "Soldiers of Fortune," or "The Bridge Builders," and would then proceed to go over the work from end to end. He would talk to the foremen and men whom he knew in a solemn but affable manner as much as to say, "You all know me, boys, I love you all but you must hustle the work along. I am soft hearted but you cannot fool me. I am old man Wise's only son." On occasions he would hand a ten-dollar bill to some old and faithful retainer who accomplished some daring feat before his eyes, such as wheeling a barrow of muck along a single plank above a raging mule. Then he would depart to the next point under the impression that he had made a tremendous hit. After he had blown in, blown up and blown out, the men would talk it over.

Did they say one to another: He is a great man, he knows us like a book but he is our brother, let us work as men never worked before? They did not. They talked over the gentleman's latest auto smash when he was out with Mamie Dusenberry, the actress (it is a mystery how they knew of it), how much money he dropped the last time he was in New York, and they agreed that he was "bugs" and was shortly due for the "nut factory" and concluded with "get busy, here comes that thrice benighted 'Walking Boss' and the 'Old Man.'"

The result was that the work was in a most horrible mess, and as this man had persisted in holding the reins himself, everyone on the work had a great contempt for him and, however good the men might be, they had lost heart working for a man of that stamp. On the other hand, if he had stayed away from the work and hired a superintendent in the first place, his actions would have meant very little to the men.

The writer has seen exactly the same results where the superintendent spent about one week every month trying to solve the famous problem of "What is whiskey?" The men discussed the matter, usually coming to the conclusion that the "Old Man" was all right on any class of work but the booze "had him," and they spent so much time talking it over that they had no time to do work.

In addition to this, looseness in their superiors' morals is taken by the men to mean unlicensed liberty for them.

The next qualification of a superintendent to handle work successfully, is to be able to turn his hand to anything on the work. A man has a high regard for a boss who can run a hoisting engine or a drill, if occasion requires. Usually the latter has plenty else to occupy his leisure moments.

In this connection the writer recalls an incident that occurred while he was in charge of work on the Buffalo Water Works tunnel. The orders were to set up, drill and shoot the heading even if there was only half a gang out and no excuses counted. Owing to some of the men being unavoidably detained at various points on the evening of pay-day, there turned out on the 12 to 8 shift only one heading foreman, one drill runner and one helper. They made their shot, however.

The Assistant Superintendent in charge of the shift alternately pointed the poles and helped on a machine with the heading boss who ran one drill and drilled one side of the heading while the solitary drill runner and his helper handled a drill on the other side. That Assistant Superintendent's stock went up 500 per cent. with the men as he and the others accomplished something that required many more men to do.

The heading gang usually included a heading foreman, four drill runners, four helpers, and a nipper, and while the depleted gang drilled a six-foot round where the regular gang would have drilled an eight-foot round, it still remained a remarkable shift's work, and the moral effect was just as strong.

Another point a superintendent should observe, is to keep in close touch with all his men. He can best do that through his "walking bosses" and foremen and by keeping his eyes and ears very wide open all the time.

The gossip referred to previously is a useful source of information. It is not to be inferred that it is a good thing for the superintendent to stand around listening to all the old gossips on the job. He can go on about his business and a word here and a look there will give him a hint, while a few words overheard will disclose some future plan or past happening that it is policy for him to know. If it refers to anything that is past let it go, as it does no good to rake over matters that have gone by except that whenever there is the least chance give some of the parties concerned, a casual hint that you know all about it. It is not necessary to go out of one's way to tell them that all is discovered but that their villainy will not be punished this time. There is nothing in such a method. Just a hint broad enough for them to understand. They will be quick to get the impression that the "Old Man" knew about it all the time and that it was of no importance anyway, also that said "Old Man" is a hard one to fool, and that is a good impression to foster.

The writer had a Time-keeper on a job and the men admired and respected him immensely even though he was only a young man and, besides, green at the business. Of course, many of the men tried to "put one over" on him. He was naturally alert and discovered these harmless little attempts to draw unearned increments sooner or later, often through a tip from the Foremen or by a scrap of talk elsewhere, and sometimes not for a day or two afterwards. He knew that if he said anything then, the man would think it took a long time for him to find it out and that, next time he might get by with it. Therefore, he carefully crossed off the day or half-day as the case might be and let matters run until pay day. The gentleman with the inventive mind would come up for his pay feeling a great satisfaction with-

in him but upon drawing his envelope would receive a rude shock. Of course he would immediately appeal to the Time-keeper with the complaint that he was half a day short; then the latter would tell him the days in the week he had worked and the ones he had missed and the man would then start his little bluff about the day in question. Whereupon the Time-keeper would recall the fact that the man had done certain things and wind up by telling him not to try any more of that business. Having no data on the subject the workman could not know whether the truth was discovered the day it happened or a week later and the Time-keeper's stock went up in the market.

It is the same with a superintendent, he should also become familiar with human nature as applied to the particular class of labor he has at that moment. This is not so hard as it looks. These laborers are very primitive in their habits, and their impulse is to go straight ahead for a desired goal. Given the objective point you can readily plot out their course toward it and act accordingly. The point is to find out what they are after, although when employing aliens who speak a foreign language it is hard for the superintendent to keep track of things unless he has been blessed (or cursed) with a long experience with men of the nationalities in question. In any event it is absolutely necessary to keep your ear to the ground at all times.

Another very important point to observe, is to act squarely with the men down to every little detail. In fact, the superintendent should be more careful, if possible, about being absolutely honest with his men than he would be with his business associates. It means a lot more to them. He can do more harm by promising a man a raise soon and not giving it to him, or by letting some laborer fill a foreman's place for a few days without giving him the additional pay than in almost any other way.

A man should not be promised anything unless there is no doubt whatever that the promise will be made good. It is also a bad scheme to be continually working the men overtime a few minutes to finish up something or for other reasons. If a man is promoted for a day or two and fills the place of a higher paid man he is entitled to the extra rate while he is doing the work. If he is not worth it, he should not be given the job. If he is promoted to fill in and gets the extra pay once he will exert himself to qualify for the next opportunity. If he gets the place and not the pay he is dissatisfied and becomes "a man with a grievance" which emotion is about as useful on a construction job as a can of nitro-glycerine in a boiler shop.

In other words, give the men every penny that is coming to them and at the same time let them understand that they will get nothing more, and then they in turn will give the day's work for which they are paid and something more.

Another useful thing to remember is that you should never condemn a man unless he absolutely deserves it. It will help immensely to have it very explicitly understood what each man's duties are, so that anything that happens within his province can be laid to his door without any further evidence. There are things, however, that cannot be blamed on any one man, and even though a strong suspicion points to a certain one, still that is not enough.

You should be absolutely sure of your facts before you start to read the "Riot Act" to any one, for, if you get after the wrong man, it not only makes him sulky but it also gives rise to the general opinion that you are liable to get after everybody whether they are right or wrong. That in the eyes of the men marks a superintendent as a man who does not know much. If you unerringly light on the one who is to blame, which can be done about ninety-nine times out of one hundred, the men will know that if they attend to business you will let them alone. Regarding the odd hundredth time you are wrong, just let it go after you find out that you made a mistake. It does no good to rake up the old grievances.

Still another important point is that the superintendent should not talk except to give an order and that should be cut short. It takes time to make long explanations, and it is a psychological fact that a man will wait until you are done talking before he starts to do the thing he is told to do. Above all do not go around growling and fault-finding all the time or the men will get used to it and pay no attention when you really have some kick to make or an order to give. Mind you, I do not hold that you should have no talk with your men. They are human beings and, if you have known them long enough to know they are allright, a few remarks when you feel inclined and the work is not too pressing lessens the strain somewhat, moreover, a little chaff occasionally goes as far with some men, notably colored men and Poles, as a little extra money.

We have seen one large husky Senegambian apparently "all in," and no bluff about it, from a combination of powder smoke in a tunnel heading and a "hold-over jag," brought to life by the chaff of a walking boss whose humor was of the sledge-hammer variety. On the other hand, we have also seen an entire gang knocked out by the same combination and smartly resurrected and set to work by a short and compressed address from the superintendent, said address while not being entirely profane was of such a nature as to penetrate a bullet-proof screen or scorch the paint off a bridge. In fact, as one of the drill runners stated later, he would rather have some one put Paris green in his coffee than have that man talk to him in that strain again. The two cases varied in the methods applied and while each remedy acted as per schedule the results might not have been so good if the cases had been reversed. Which one of a dozen cures to apply in each particular case must be decided by the man in charge and the writer knows of no formula that will cover the various cases.

Another matter that has been debated at length, is whether or not a superintendent should use sulphurous language when he desires to "bawl" out a given person. It is a much mooted question and the writer does not desire to moot it any more but in passing wishes to state that from personal knowledge he knows that it certainly is not necessary for some men to use any profane language. They can squeeze enough vitriol into about three or four sentences to give a penetration of sixty milimeters in six seconds. There are also people still extant who in a similar emergency would be club-footed in their speech, so to speak, if they had to express themselves without a few naughty words per square inch. Wherefore, as before stated, every man to his own fancy in that line. Of course some will ask: Why is it necessary to land with both feet, as it were, on these lowly toilers at all. On one job on which the writer was engaged there were only about two hundred men working so there were only two hundred reasons. There have been times when there were over two thousand.

It is a fact that from the time when as a schoolboy you were verbally (and otherwise) flayed by the teacher for some mischief, you have been more or less mixed up in these rebukings, sometimes on one side and sometimes on the other. And when you become Superintendent on a construction job, and the night foreman tells you in the morning that they hoisted only sixteen buckets of muck, because the fog was so thick that the hoister runner could not find his way back to the fire door, or that they mixed only eight batches of concrete because a monkey wrench fell against the commutator of the concrete mixer and short circuited it with the water barrel, then you naturally regard it as an auspicious occasion to make a few remarks concerning foremen in general and this one in particular. You might confine yourself to a fatherly talk to him regarding the necessity of finishing this particular work before the year 1921, you might indeed, but the chances are you will not.

There is still another place where many superintendents stumble. Some of them after they get the job think that they are at the top of the ladder and that having gained such a place they have nothing more to do or to learn. On the contrary they are just starting. We have seen superintendents who wandered aimlessly around the work with their hands in their pockets, like a boy going to school the day after vacation, and usually appearing as though he were lost and could find nothing to do. That is a very poor policy and very bad example for the men. If a man has an active brain it will usually show in his actions.

Some men will stand still and look ten times more alive than others who fly around. If you have absolutely nothing to do, go in the office and do it. We think, however, that even on a small job a superintendent will be able to find enough to do. If you feel out of place or, as the artists say, "out of drawing." then look around a bit and get right into it.

Do not stand on a pinnacle and gaze around, get down in among things where you can obtain a view of the work. If not busy on administrative matters, go where there's work and if you see a foreman who is handling his job badly, help him out. Use your brains to facilitate matters and show him short cuts then move along to the next gang, or else go outside somewhere and hustle in material to the gangs or hustle out the excavated material.

Don't yell at people. They all resent being yelled at just the same as you would. Do not blame the foreman when things go wrong unless he has done something according to his own private scheme. In that case rub it in a bit and let it go. There is more money made trying another way to do it and moving right along than there is holding post-mortems.

It is also well not to take life too seriously. If you can not crack a joke with the walking bosses and foremen you can at least be pleasant and pass the time of day. I know of some, and have one certain superintendent in mind who goes around with a "suffering sad humanity" sort of an expression and stands aloof enshrouded in a large "gob" of gloom. When he does have anything to say to the walking bosses or foremen it is accomplished in a serious and dreary manner taking on much the jocular style of a consultation of specialists trying to decide whether to remove a patient's ap-

pendix and take a chance or to let him die, or of a meeting of the executive committe of the Society for the Eradication of Mirth.

Finally, do not run down your men should they leave you. Some superintendents never can say a good word about a man after he once leaves them and they seem to think they have a grievance against him for so quitting. In a number of cases your foreman will leave you to go to another job where he can get more money, which, when you come to look it over, is entirely reasonable. If you say a man was no good anyway, after he leaves, it shows poor judgment on your part for keeping him so long. Personally, if I had a man I thought was no good he would have to leave very quickly in order to get away before I discharged him.

When you have a good man and someone inquires about him give him a boost. In the long run you will keep more men that way than by giving them a bad name. If you cannot pay money enough to keep them let someone else have them for they will get away in the end, and if you speak a good word for them and treat them honestly the chances are ten to one that you will have them again later and that they will remember that you are a square man. They will spread the news and a few men like that are as good as an employment agency. If a foreman leaves you at a critical time or in a bad hole, that is a different proposition, but in any event don't talk about it.

To sum up then, the superintendent, in dealing with his men, should be honest with them to the last penny, see that they get what is coming to them, keep an extremely sharp eye on their doings, keep his ear open for information without seeming to do so, be among the men on the work whenever possible, give his orders as concisely as possible. Above all he should not growl all the time or wear a grouch, but if there is any legitimate kick to be made make it, and make it hard, being first quite sure of the facts. Finally, the superintendent must make it his business to master all details of the work, he must be temperate and live a clean life and be as good-tempered as possible.

These and a few other little things will help him immensely.

The Contractor and His Superintendent.

Now as to the relations of the superintendent with his employer. To start with, a number of contractors who have been through the "mill" themselves regard a superintendent as a luxury and some of them dispense with him, cutting the work up into sections with a man called a superintendent over each section while the contractor himself is supposed to be taking the general superintendent's place and supposedly saving his salary.

To any argument they answer, first, that they know more about the business than any superintendent that ever walked, and, secondly, that they are making money. As to the first argument it is not an argument at all.

For instance the writer knows of one case where the contractor has been contracting for thirty-five years and was foreman, etc., for several years before that. His superintendent has been at the business about twenty years. Now some would say that given equal brains this contractor should be the best man to handle work, but it is not so. To begin with he never held a contract in his life as large as the one he has now which amounts to about $350,000, while most of his contracts were from $3,000 to $20,000. Probably the total work he had completed during his experience amounted to about three or four million dollars while his superintendent had been in actual charge of work costing over twice that amount and had been connected with, say, about fifteen million dollars' worth of work. On the other hand, the contractor had gained his experience years ago when conditions were different, while the other man is still gaining his and keeping up to date in all details. The contractor in question realized these facts, hence his hiring the superintendent.

As regards the other argument, it is true that the contractor may be making money, but the question is not whether he is making money but how much. The whole thing is similar to the handling of a railroad or a manufacturing plant. The president of the railroad is usually an expert railroad man, but he feels that he needs a general manager or vice-president acting in that capacity, while operation and maintenance also are usually under a general superintendent, if the system is not too big, and another vice-president, if it is large, and so on down the line. The same condition exists in manufacturing establishments, large and small, and is good business.

The fact is, moreover, that the contractor, if he is a good business and financial man, can not keep track of that end of his business and, at the same time, follow the details of the work; neither can he split up his work into sections with a man of minor ability in charge of each, with, possibly, a junior member of the firm to keep costs and to handle the supply end of the work. This is simply doing work under half a dozen different methods when it should be done under one and the most effective method, and it also causes endless friction.

As to a superintendent's dealings with his employer. He should, first of all, after carefully looking over the work, upon taking hold of it, be able to give his firm a fairly accurate outline of the manner in which he intends to handle the contract, the plant he will require, and the organization he proposes to have; also the salaries to be paid to the more important members thereof. It is true that a man can not foresee all the contingencies of the work and provide for them, but it is equally true that unless he lays out a general plan and sticks to it he will never get anywhere.

Many superintendents have lost the confidence of their employers by jumping from one scheme to another, and it is not fair to an employer to expect him to pay for experiments.

In addition to this the superintendent should keep track at all times of a number of first class men in each department. Forget the poor ones, they can be found at any time, but be sure to know where you can at any time lay hands on the good ones.

If the work is under way when you take hold of it, make out a list of plant needed, first of all, so that your employer will know the worst immediately. He can sleep better then. Then look over the work, and begin at whichever end seems the worst handled. That is, work from the raw material end to the final disposition of the product in place, or vice versa.

On an excavation job it will amount to the same thing, whether one works from disposal to excavation or the other way round.

Take one thing at a time and organize each step until you come to where it overlaps the next step and then pass on. After you have done this you will have the things in fairly good working order and you can then add the finishing touches. When things are running smoothly you will have leisure to work out improvements. Above all do not start in by discharging all the foremen and substituting men of your own. If you do that, you might as well discharge everyone and shut down the work for a few weeks until you get a new organization together, for you will get very little work done. It is much better, to be sure, to have your own men but your employer wants results and his interests should be considered first and your convenience next. Besides, very likely there are good men on the work and it is well to know of several good men for a certain position than to know of only one. Therefore, it is important to go over the organization carefully beginning at the top.

If, in your opinion, a man is doing good work leave him where he is. If he is not, drop him quietly and put one of your own men (taking care to pick the best only) in his place. Do the same all along the line and you will soon have an efficient organization, and the holdovers will see that they are safe as long as they do good work. At the same time, you will be going along with the work and improving both progress and economy.

Handle the work not as if it were your own but as if it were someone else's for any honest man will be more careful with other people's property than with his own. Keep close watch of your costs and also of the actual work and cut out all frills. Handle your work to the best financial advantage of your firm.

For instance on tunnel work, your inclination might be to drive the heading through first and then take up the bench afterwards, but as the heading will probably cost as much as the firm is getting for it and the bench much less, it will be to the financial advantage of the firm to take heading and bench both out together apart from any saving in cost; in other words, mix the good with the bad so as to maintain an average. The writer has seen superintendents who, upon starting a job, get right into the cream of it and when that has been about skimmed off they leave the work, with great reputations as money makers. Then another superintendent would labor faithfully to make a good showing on work in which, at best, there was a very small profit and which he has to handle with a worked out plant.

Another important point to be considered by the superintendent when he needs new plant, is to give the firm as much leeway as possible. Do not insist on any special style or make of machinery unless there are strong reasons for doing so. Plenty of men will say that a certain make of hoisting engine is necessary to their happiness and no other kind is any good. Things like that often cause a contractor much trouble and expense. The same man who insists so strongly on such matters often will be most careless in other respects.

The plant must be arranged so as to require a minimum number of changes. Lack of careful consideration of this feature is a source of delays and loss of money in many cases.

Lastly, in case a superintendent is removed or given notice that he will not be needed after a certain date, or resigns for any reason whatever, it is distinctly his duty to work up to the last minute as if he expected to be on the work for ten years more, and to leave matters in the best possible shape for his successor.

On the other hand, if you are the new man do not start in by saying things

about your predecessor, if he is gone, or treating him as a suspicious character, if he is still on the work. These are a few of the things that a superintendent owes to his employer.

Now, as to what the employer owes to his superintendent. First, he owes him a definite agreement for a term of, say, a year, anyway. If a firm wanted to engage a high-priced salesman and expected him to work by the month they would be laughed at, and the same applies to the majority of other positions requiring ability equal to, or less than, that of a construction superintendent.

Once when negotiating with a contractor he told me that he would not make any agreement with me except by the month. He was entirely satisfied with my references, had been on my previous work, and, in short, everything was satisfactory, but, still, he did not wish to tie up with me for a year. Why? Oh well! I might suddenly go crazy or get drunk, and he wanted to be free to fire me; also, he might want to change his mind at some later date. He could not understand my objection to these terms. He had spent six weeks diligently hunting over my past work and looking up my references while all I knew of him was that he had several contracts and was supposed to have enough money to carry them along. It did not occur to him that he also might get drunk and do the very things he thought I might do and it did not strike him that his attitude was one-sided and unjust.

It certainly is not fair to engage a man who usually has to move a considerable distance, bringing his family, who must set up a new home and start out under new conditions at considerable expense, and then to ask him to work from month to month. He is surely entitled to a little more consideration than an office boy and when he is accorded consideration it smoothes matters wonderfully for him.

The superintendent should have a free hand in running the work. Some will say: What! Hand my business over to a stranger for a year to make or break; I guess not! This is an extremely narrow view of the question. In the first place, they should know all about the man before they engage him both from looking up his references and from looking up some of his work, if possible. Also as I have pointed out they should go over the work with him at first and get his ideas about the plant, wages, etc., and settle these items when he begins work. That leaves very little to be guessed at and if they will make a three months' contract at first to be extended a year more, provided it is mutually agreeable, they have then eliminated all uncertainties for both parties to the agreement.

In addition to the foregoing, it is due the superintendent that no one above him will interfere with the men and no one should be put to work excepting through the superintendent. This may appear like a hard case to some but the aspect will be softened by a glance at the balance on the ledger six months after these changes go into effect.

The Assistant-Superintendent.

Having given the contractor and his superintendent the attention they deserve, we will now proceed to look over the remainder of the force. Under the superintendent, as a general thing, there should be a "walking boss" or assistant superintendent for each shift worked. You ask why? Because one man can not be in two places at the same time and because it is too high a step between superintendent and foreman.

Take, for instance, tunnel work, using as an illustration the Buffalo Water Works. On the intake tunnel there were in operation at times two shafts with two headings in each shaft. The writer was General Superintendent and had three Assistant Superintendents. Each one of them had charge of an eight-hour shift and they changed every two weeks, moving one shift ahead thus keeping their own shift of men the whole time. The men who filled these positions at the different periods were all high class men, had risen from the ranks either with or without an engineering education to start with. It might be inferred that the man on the day shift would have an easy time because the general superintendent was also on the work, but the rule was that all repairs, changing tracks, etc., should be done on the day shift, and this extra work kept every one busy.

As to the qualifications for a "walking boss" or assistant superintendent, he should be practically an understudy of the superintendent and of sufficient ability to hold that position after he has had a broad enough experience. This is a position where the practical man is often worked in nowadays to bolster up a superintendent who is "long" on theory and "short" on practical knowledge and ability to correctly gauge the "artistic temperament" of the men he happens to be handling.

This combination usually proves to be a dismal failure in the management of a job, the chief reason being that the two men look at matters from widely divergent points of view. What one lays stress on the other treats as of no importance. Furthermore, they have no respect for each other or for each other's opinion. There is one thing that neither a "walking boss" nor any other employee should do, and that is to criticise his superior or employer. It is without doubt the surest way to create a feeling of unrest among the entire force, and it will demoralize an organization quicker than anything else known.

In dealings between the superintendent and his assistants the former should discuss with them any proposed changes of importance and get their opinions on the same. While it may not be necessary at all times, it is better to do it so as to get the different angles of view on the change before it is made, thus helping the superintendent to arrive at a satisfactory solution of the different problems. Also in bringing out the different opinions it is well to ask these men each separately what they think of the proposed change, giving them to understand, at the same time, that such change has not been definitely settled. Otherwise, it is surprising what a number of unqualifying endorsements you will get about the change. It is not because these men think they have to agree with the "boss," but because they may have had much bitter experience in criticising the pet schemes of some one higher up and are chary of expressing views on something that has already been settled.

To assistant superintendents the writer would suggest that it is a good policy for them always to give their honest opinion on any questions arising, for, even though their advice be not followed and matters turn out as they predicted, their recommendations will be remembered by those in charge.

There are also numerous things that come up regarding which the superintendent cannot seem to decide either way. He may have some slight inclination in one direction, but if any of his assistants presents a strong argument on the other side of the question he will get a new view of the subject; whereas, if they all agree with his first inclination, he loses the benefit of what may be very good advice

A very important point to observe is not to play any favorites in the ranks of foremen or men. Advance the man who gets the work done quickest and most economically.

As a final word to both superintendents and assistant superintendents, I say, do not think, because you are the boss, that you have to be able to take off your coat and "lick" any man on the job or make a try at it. Many men, Englishmen, for instance, think that if you are boss and one of the men should stick an exceedingly dirty fist under your nose, by all laws and precedents, you are called upon to carefully remove your coat and vest, roll up your sleeves and dramatically say "come on now." After which, according to the story books, the "super," who is a little man, sails in and knocks what is generally termed the "eternal stuffings" out of the presumptuous laborer.

The foregoing narrative, however, often does not work out in practice, because the quantities may be reversed, thus throwing out the entire formula. Besides, a superintendent, "walking boss" or any other man in charge of work is hired to work not to fight, for his brains, not for his muscle. He is a fool to go into a fight with a man who is working for him, as the latter has all to gain and nothing to lose, while the man in charge has all to lose, for if he once gets whipped he had better move off the work, as he will be of no further use there.

But some one will say that at times you may be placed in position where you have to fight or back down, and the latter is very bad policy. Ah, too true! Too true! Such is sometimes the case, but, in such event, be sure there is a 2"x4" handy, or a starter or a monkey wrench at hand, and finish the fight with one swell finale, as it were. In the words of Terence Mulvaney, "Don't fight, but if you must fight with a man knock the face off him first and frequent." Have peace, even if you have to knock out a man with a chuck wrench to get it.

I recall visiting in a semi-Southern city, a contractor, part of whose name was Warren. While I was talking to him a colored gentleman approached in a very hostile manner and in a most aggressive tone demanded his money. He wanted it right then and there, and finishing by putting his face close to Warren's he remarked, "Mistah Warren, if I don't get that money, there is going to be trouble." "There sure is," remarked Warren, as he side-stepped and picked up a club, "and it starts right now." It did, too. He hit him only twice and the the second time he had to make a long reach as the colored brother was on his way. The next day was pay-day and the same colored gentleman approached Warren with his hat in his hand and said apologetically, "Mistah Warren, I was drunk yesterday or I never would have said that to you." "Correct," replied Warren, "and you better go back to work this afternoon," and he did so.

Some one rises to remark that this system is not fair. Possibly; neither is it fair that some one conspicuous for lack of brains and possessing muscles should take advantage of that fact to put you in a position where you have to fight or lose all influence over the men. Hence, I advocate the quickest method.

The Master Mechanic.

On work of any size the men next in importance to the assistant superintendents are the master mechanics and the office and time-keeping force. Hence we will now attend to their cases.

These two departments are frequently bones of contention as to whether they should come under the assistant superintendents on the various shifts or not, and that is a question which should be settled, according to the circumstances of the case, as there are good arguments on both sides.

The master mechanic should be preferably a machinist, with a long experience on contract work. A man of that stamp is capable of erecting and running economically a machine shop of whatever size the work requires, besides being familiar with the various parts of the plant and their erection and handling. He will also be handy on rough and ready repair work such as is often necessary on contracts located in out of the way places.

A master mechanic should be familiar with machine shop work, because a shop is a great time and money saver on even a medium sized job, for if the contractor has to depend on the common or garden variety of machinist to run it, the results are startling and expensive. On the other hand, a master mechanic from a big manufacturing plant is about as useful on a construction job as a silk hat in a lumber camp.

It goes without saying, that a master mechanic should have enough education in technical matters to enable him to figure the horse-power of engines, pulley ratios, etc. Of late years a number of graduate mechanical engineers are taking up work with contracting firms, and if these men work up from the bottom and thus get the practical experience, they are, of course, to be preferred for the position of master mechanic, but some of the foregoing remarks about the things a superintendent should know apply also to this type of master mechanic.

The mechanical department often makes or breaks a contract, and one cannot be too careful in selecting a man to take charge of that work, more so because it is extremely difficult to check up results, from day to day, as is the case on other parts of the work.

The master mechanic's gang should include not only machinists and pipe fitters but, also, men who are riggers, cable splicers, or otherwise handy. Aside from this, the outside gangs and the shop men should be kept separate and distinct, as nothing demoralizes shop work so much as having the outside men working in the shop at odd times. They are not familiar enough with the shop to know the system used, and, therefore, cause confusion which lasts after they have gone out again. Moreover, the work should be so laid out that certain lines of it are always done by the same man.

For instance, one man should do all repair work on air or steam drills, another on cars and others on locomotives. Of course, if the job is small, one man could cover two or three, or more, different items.

The master mechanic should be impressed with the fact that all pieces of plant coming in the shop should either be repaired or put in the scrap heap or disposed of otherwise. The writer recalls very vividly a trip over a large contract where the contractors had failed. There was an unusually large number of cars minus one wheel, drills and tripods short of some part, and hoisting engines with broken castings. On that same job the master mechanic had an elaborate office and a clerk, and spent much time plotting saw tooth charts and graceful curves showing just how many kilowatts, B T. U.'s, horse-power-hours, cubic centimeters of air, hot or cold, ohms, foot pounds, or other "jiggers" had been consumed, used, or otherwise demolished. The only thing they had no record of was the consumption of money caused by gangs waiting for stuff to be repaired, or by paying ten dollars for a new article when one dollar would have repaired an old one.

An important branch of the master mechanics' organization, especially if the work in question is a tunnel, is the electrical end, and that should be looked after by a foreman electrician on the day shift and one or more electricians on each shift. The chief electrician on a construction job must know a little of each branch of the work.

Office Force.

This part of the organization, of course, varies with the size of the work, but on the average contract it usually includes a bookkeeper, who also acts as purchasing agent, and a timekeeper for each shift. It is necessary that the bookkeeper be a pretty good business man if he has to handle the buying besides having to be familiar with the workings of one or more timekeeping systems and, also with the different methods of cost-keeping. Of these the writer considers that the handling of a simple and reliable time-checking system is the most important.

The buying done by the bookkeeper usually includes only small tools and the lighter supplies, for almost all the important materials or supplies are bought by contract. The book-keeping is usually simple, because everything is checked up at the home office in any event, and with a good checking method the work of keeping costs is cut in two.

The Time-keeper and Time-keeping.

Now as to time-keeping methods: The writer will discuss some of the many he has come in contact with and will state the advantages and disadvantages of each. These systems may begin with the crude one used by a firm of three men in the South whose first names were, Joe, John, and Pat.

Joe was small and slight and kept the books, and on pay-day checked off the men as they came by. John was larger and he stood by the pay window and passed out the envelopes, while Pat, who was in the heavy-weight class, tipped the scales at 200 with no extra flesh and had a fist like a tea kettle, stood outside the pay window.

The firm ran a commissary and the system was simple. It consisted in giving each man, on pay-day, an amount ranging from fifty cents to two dollars and taking the rest for what he had bought at the commissary or what he should have bought or was going to buy. On pay-day the system worked thusly: John called a name to Joe as a man appeared at the window, Joe selected an envelope, passed it to John and checked off the name, John gave the envelope to the man at the window, when the man passed on, the system ended there. If, however, he stopped to argue about the shortage, John told him to move on; if he did not, John said, "Hit him, Pat," whereupon Pat smote him, preferably with an upper cut on the jaw and then moved him along. A very simple system. Did not necessitate a time-keeper or anything like that and was also exceedingly inexpensive. Funny part of this, is that the story is true and that the firm got away with it and the three brothers are now all wealthy and, I believe, respected citizens.

The other extreme was illustrated by a gentleman with whom I am acquainted who was planning an organization for a big contract. He proposed to have a bell ring or a whistle blow every hour, whereupon messenger boys (he did not state how many) would rush out to the different gangs and take from the foreman a card filled out with each man's name, the kind of work he had been doing for the last hour, the amount he had done, why he did it and any remarks (not necessarily profane) from the foreman. These cards were then rushed to the office and a gang of computers took them and plotted curves, showing each man's work for the hour. A group of curves represented a gang and each of the individual curves represented a man, showing, for instance, that Jan Larsen had shovelled 47/100ths of a cubic yard of loose rock into a car during the hour; Antonio Frangonetti had dug down one large stone measuring 129/150ths of a cubic yard, made a trip to the tool box for a pick handle and had thrown two small stones (size not recorded) into the car, while Carl Heifenberger shovelled 19/46ths of a cubic yard of loose rock into the car, hit Hop Sing Lee with a shovel for dropping a bar on his feet and took a drink of water, thus giving a basis of comparison for cost of loading loose rock.

After the computers finished with the cards, they went to the recording clerks who entered each hour's work on the credit side of the man's account. At noon, the honest toiler encountered a set-back The cost of his noon meal was carefully charged against him and every hour through the day returns from the company store were handed in and the recording clerks charged up the miscellaneous supplies to the different parties who bought them. In the evening, they were charged with another meal and during the night they were charged with one sleep at so much per.

There were many other details, but the chief idea was, so I was told, to know just how any given man stood at any hour, besides keeping absolute track of the costs. The advantage of knowing how any man stood, I could not see aside from its being handy if he quit. It was not explained to me whether each foreman had a private secretary and a transit and level, or whether he had an assistant to do the work while he did the other things. A funny thing about this story is that it is also absolutely true in all details.

Now, between these two extremes, are many sane and reasonable systems. These, of course, have to be varied according to the different kinds of work.

For example: On one contract under the writer's charge, the work was in a mountainous country and required a ride of thirty-six miles to reach all parts of it. The work included logging, dam construction, tunnel work, road building, open excavation, etc.

On this job, a Time-keeper was assigned to cover part of it each day. Two men were employed at first, and each covered half of the work and checked up the time of the men then on. As the work increased, the system was revised and, finally, at each camp (eight in all), a Time-keeper was placed who checked up the men's time and kept track of the commissary, etc. Each day

he handed in his report to the man from headquarters who covered that part of the work, so that a complete record of the previous day was posted daily. This worked very well indeed.

Another system was used on the Buffalo water works tunnel. All the men were provided with a numbered key which fitted a time-clock. As they went on shift, they filed past the clock and rang up the time, and they did the same thing on coming up out of the tunnel. After they had gone to work, the Time-keeper on the shift who had watched them ring up to see that one man did not carry two keys, removed the slip with the men's numbers on it from the clock. He then checked the numbers against those in his time book. Later he would make two trips into the tunnel and check up the men, noting where they were working. In this way, there could be no mistake because each man had to register on the time-clock and also, must be seen by the Time-keeper, in order that his time be counted. If the Time-keeper could not find a man who had rung up, he would inquire and occasionally find that the man never went into the tunnel. On the other hand, a man sometimes neglected to ring up, but the Time-keeper would find him on the work and saw that he rung up as he went out. Therefore on pay-days, if a man claimed to be short, it was only necessary to look at the time book, find the day or days he had been "docked" and then examine the paper slips from the clock on those days to find out whether his number was stamped on them. If he had duly rung up, both going on and off, he would be paid for the time; if he had not, he was not allowed his claim.

The point is that there cannot be a good system of time-keeping without a method of checking up the men when they are actually at work, and doing it twice each shift. Another check, such as a time-clock or other device, should also be used to make the records doubly sure. To do the above, a first class time-keeper is needed, and contrary to the general idea, they are not very numerous. There are many contractors who spend large amounts for plant and in other directions, but who think that fifty or sixty dollars a month is good pay for a time-keeper. They usually pay ten times that for blunders in the pay-roll, mistakes in the men's time, besides losing money by having good men leave the work after they get disgusted with the poor time-keeping when they are continually short on pay-day. Therefore, the time-keeper is a very valuable adjunct to the contractor's business and should be regarded as such.

Contractors should see that most of their time-keepers are experienced men, and it will be policy to pay enough to get that kind. Some new men can be mixed in, but the man in charge of the work must make sure that they are properly coached in the various details of handling the festive mucker. Many new time-keepers, when told they are not to let the men bluff them, take it to mean that when a man comes in to make a "kick" about his time, he is to be fired out. This is an erroneous idea for several reasons, one reason being that the aforesaid mucker may carry a punch in each hand. Also, perhaps the man's complaint is legitimate, and if he is put out without a hearing, the result is a spirit of discontent in that man which is sure to spread and make itself felt.

It is a bad idea for a time-keeper to think that he can not make a mistake, for, if he does think so, he has already made one. It is likewise well to bear in mind the fact that about ninety per cent of men who argue about their time are either right in their contention or are honestly mistaken. Only a few deliberately plan to run what is technically termed a "whizzer" on the time-keeper. Therefore, it is a good scheme to look up the man's time and explain to him where he is wrong, or to correct your own mistake, if you have made one.

When you are paying off and a man starts to tell you he is short, do not yell at him to get out or stick your head out of the pay-window and use up your breath telling him what you think of him. Perhaps he does not understand English and your "fire-works display" will be lost, or, perhaps again he understands quite well, in which case there is a possibility of his pulling you out through the pay-window. Neither is it necessary to pass him a long line of soothing conversation; merely tell him to come around the next day and see the time-keeper on his shift and fix it up then. For the present, he is to "beat it" and do it quickly.

There is a tendency among some time-keepers to go around with a chip on their shoulder. If some ox-eyed gentleman from the rocky slopes of Tyrol or some lemon-hued inhabitant of Sicily comes in the office and remonstrates about a real or imagined shortage in his time, do not take loud talking as a hostile move and jump upon the lowly toiler and smite him. That is mighty poor business and does not help anyone. Besides that, you will sooner or later get the wrong man and then you will spend the subsequent days regretting your move. I remember one case like this that caused me much gratification.

A certain young man from the South who stood about six feet one inch tall, weighed 210 pounds and estimated, allowed and reckoned himself to be one of the "niftiest" scrappers in existence, was engaged in the general capacity of Chief Walking Boss, Time-Keeper, etc., on a piece of work in Michigan, the contract for which was held by a company of which his brother was head. He had manhandled several inoffensive laborers and finally wound up by discharging a Cornishman whom a strike in the copper mines had driven to construction work. This man weighed about 150 pounds and did not appear to the casual observer to be any real bad man. However, the large gentleman fired him and, furthermore, informed him that he could not get his money until pay-day, and then stalked majestically to the office.

The poor benighted copper digger looked after him a minute, put on his coat and then did some stalking himself. He walked calmly into the office where the writer, who was engineer on the work, happened to be present with some others. The Cornish gentleman demanded to know if he was going to get his money. The big man stated positively that there was nothing doing and besides, that if the plaintiff did not get out, he would throw him out in two seconds or less. The benevolent looking member of the proletariat then leaned over the railing and said: "Oh no you won't throw me out, because you are a big stiff and have no sand. I am going up the street to pack my 'turkey' (technical name for bag) and will be back in just half an hour, and if I do not get my money then, I will beat you to a frazzle, and, what is more, if you go and get your big nickel-plated gun and have it on you when I get back, I will take it away from you and beat you over the head with it. Did I hear you speak?" He did not; no one spoke. The big man stood up, then sat down again and looked foolish. The small man waited a minute and then went out into the cold world. He came back in half an hour (I waited to see) and the big man was not there, but the bookkeeper was. "Do I get my money," quoth the beligerent one. "I reckon you do," replied the bookkeeper, and paid it over. Was it a bluff? Perhaps, but surely the big man was.

There are time-keepers who get sick of the monotony of checking up the men every shift and become careless. That too is a bad habit, especially when they get so careless that they do not even check up the time of the men. On one large contract near New York City, when the writer took charge as Night Superintendent, he found that the night time-keepers had given up all idea of ever checking the men, and when pay-day came, they made up the time-books according to their likes and dislikes. The results were extremely weird as their leanings did not agree with the actual facts. Also, it required the police reserves every pay-day to convince the men that the ideas of the time-keepers were even approximately right. It might be appropriately remarked that this system was changed.

A system of time-keeping which is finding much favor now, is the posting of the time every day on a bulletin board, so that the men can see just how they stand and can register a "kick," if any mistake has been made. This is all right if there are not too many men, or if they are not too widely distributed. It is a fact that in some parts of the country this does not work well as the unthinking and guileless laborer uses the aforesaid bulletin board as a target, much to the detriment of the time sheets. Also, on work such as, for instance, the New York Subway, where some contracts are two miles long, it would not be practicable to place the bulletin board where all the men could see it, as each gang has an allotted place to work, and probably does not pass the office on its way to or from work and, of course, would not be allowed to take the time to go there during working hours.

In addition to the foregoing, there are a dozen other systems of time-keeping, but as this is to be a paper on the psychology of the men on the pay-roll, we will pass on.

The Foreman.

Finally, we come to the consideration of foremen, sub-foremen and laborers of various classes and we will now investigate them. Now there are different foremen and most of them are just naturally foremen. The reason for their being in that position is, in some cases, hard to determine. I know of at least one man who was made foreman because, as the contractor stated, he was too lazy to work and he did not want to discharge him, so he promoted him. That case, however, is a freak, or rather the contractor was. There are, however, many other reasons for which men are made foremen which are about as logical.

There is an exceedingly large percentage of men who have become foremen simply because they were friends of the walking boss, superintendent or contractor. The percentage is larger than one would suppose and, in most of the cases, the person who promoted the man will indignantly deny that it was

done for any other reason than that he was the best man for the job. Usually, the person in authority really believes this himself for it is a strange fact that if one wishes to believe something he will eventually believe it and very strongly too.

The only way to judge a man's ability on contract work is to keep a close personal watch on him and his work and treat him exactly as he deserves.

I thoroughly believe in appointing foremen, when additional ones are needed, from the men in the gangs. There are, however, exceptions. For instance, it is most emphatically bad policy to put a foreigner in charge of a gang of men of his own nationality, regardless of what anyone says to the contrary. This is particularly so in cases where the men can talk little or no English.

Your foreign foreman will do either one of two things in ninety per cent of the cases. That is, he will either be so strict with his men and so hard on them that they will quit him or organize to fool him, or else he will be too easy with the gang and fraternize with them. They are liable to have too many interests in common after the day's work is done. We should get English-speaking foremen to handle foreign labor, for a man who knows his business can work in any language.

The foregoing is well illustrated in Mexico. In that country there are many men who have resided there several years and who have assimilated some of the Spanish language. They will kindly, but firmly, tell you that it is absolutely impossible for anyone to do work there from foreman to manager, unless he can talk Spanish. They harp on this in season and out and "break their necks" hunting around for some Spanish-speaking foremen. The latter, in many cases, seems to be a man who cannot get a job in the United States, but by virtue of the fact that he converses more or less fluently in pure or adulterated Castilian, he is sure of a job in Mexico as foreman. The said job is usually taken to mean that he bosses a gang of Peons and that he cannot conduct the aforesaid gang without the aid of from two to a dozen "straw bosses" or native sub-foremen. Even so, there is only a limited number of these men to be had, and after you once run through the supply, you start all over again.

These are the foremen you are told you cannot do without and you are also told that men fresh from the United States or England cannot work the Mexican labor. Such is not the case. I have seen a certain foreman from the United States make up his gang with Mexicans and get more work out of them than had ever been done before. This happened in not one but in a dozen cases, and in two or three cases the foremen were very young men. Likewise, I have seen English timber-men in a soft ground tunnel using Mexicans for helpers and muckers and getting along all right, and have also seen a gang of Irish "sand hogs" from New York working in 30 pounds of air with Mexicans helping them; and neither understood more than six words of the other's language.

All these things simply went to strengthen a conclusion which I had reached previously, i. e., that foremen can get along without speaking the language or languages used by men in their gang and without any undue wear and tear on their nerves. Indeed I have come to think that if the Tower of Babel episode (see frontispiece) had happened in this century, it would not have caused the foremen on the job the least inconvenience.

As a matter of fact, on one job of which I had charge in California, there were in one camp containing about 400 men, the following nationalities: American, German, English, Swedish, Norwegian, Austrian, Italian, French, Spanish, Portuguese, Chinese, Japanese, Hindoo, Greek, and Mexican. The various foremen and walking bosses got along with them very nicely, even though it was necessary to talk to them "by hand" occasionally. So we will pass over the foreman's ability as a linguist and consider other matters.

Back in the dim past, I once worked as Foreman for a fine upstanding, two-fisted, old Kerry man, who at that time did business in the Eastern States and who wished to personally "whale," "whop," whip or otherwise chastise every foreman who worked for him. He did not do it with malice aforethought, but, when he was angry, which approximated 75 per cent of the time, he would carefully pull off his coat and hat, roll up his sleeves and wade in. As he was a man sixty-five years old, the sundry and divers foremen who were on the job at different times looked upon this benevolent looking old man as "easy," more especially as he was only about 5 feet 6 inches tall and did not look to be within 40 pounds of his actual 200 pounds weight. However enthusiastically his opponent started in, the finish was always the same. The "old man" was the invariable winner. After which, he would resume his coat and go on about his business and the foreman was good for a job with him whenever there was a chance.

Now, I had observed this old "party" in several encounters and noticed that he enjoyed himself immensely during the same, and the hotter the battle was, the happier he seemed. Moreover, I had noticed that he possessed a fist about the size of a ham, had a pair of shoulders exceedingly wide, that he was very light on his feet and, altogether, entirely too frisky for a person of his years.

Observing these things, I made a bet with myself that if my popularity with him depended on being "licked" by him, I would prefer not to be loved. Hence, when we conducted any arguments, I invariably chose the opposite side of the sewer trench. As usual in the construction of brick sewers, one side of the trench was reserved for piling the brick. Well, that was my side.

When the storm finally broke, it found me so situated, and when the old gentleman started across on a brace to reach me, I collected up a few bricks, commonly called "Dublin Confetti," and delivered an ultimatum. I had unwittingly hit upon his one weakness, for while he would have been overjoyed to tackle the champion pugilist of the world, he owned a horror of bricks, clubs or anything that mussed a man up. So he went back and spent ten minutes begging me to put down the bricks and come over and fight like a man, and ten more, calling me names. He then went away and I had greatly fallen in his estimation. He told me so the next day, said I was a fine boy but had bad ideas.

Now, I do not regard the foregoing as an unmitigated success in handling foremen. I believe the proper method is to give them your instructions (that is if you are dealing directly with them) and condense these instructions as much as possible. Also, in dealing with them, keep moving. Do not go out on a job and sit down to talk to them. Do your talking standing up, and if you want to sit down, go in the office and do it.

If you have a foreman and he gets an offer of a better job and you cannot make him as good an offer, do not get angry about it and make it unpleasant for him. Let him go cheerfully (on the outside at least) for it will do no good in any event to act otherwise. Firstly, it gives away your hand, and, secondly, you may need him again. If he leaves thinking well of you, and saying that you are a fair man, he will in all probability come to you again for a job, and besides that will advertise the fact that you are square, which does you no end of good.

There is another sort of foreman to be shunned and that is the kind that you have to interrupt in long conversations with the men. When a foreman suffers with the hallucination that he is on your work for the purpose of talking politics or religion and not for business, he is a good man, to use a polite phrase, to "hit in the neck with a time check."

Until about ten years ago, it was universally admitted that the Irish were the best foremen obtainable; in fact, they had a natural aptitude for construction work that amounted to genius and they stood alone in that line. Now, however, it seems that the American born men are close on their heels, if not abreast of them, and the English are not far behind.

Work has been more divided up, or specialized, of late and we find different nationalities naturally adapted to different branches. Thus, in steel construction we find numbers of Swedes and a large proportion of Newfoundlanders and men from the Eastern Provinces of Canada, these men being natural sailors and handy with rigging work. On timber crib work, trestles and pile-driving, we find French Canadians, Michiganders, and men from the other lumbering districts, and so on.

Therefore, in selecting new foremen, it pays to try out a man on different parts of the work as he may be an expert in some lines while very poor in others. Of course, the ideal foreman is the man whom you can put at rock work, steam shovel work, trench work, concreting, etc., but that sort of a man is hard to find, and when a contractor finds him, he usually makes him a "walking boss."

Then, there is a great deal of promoting by seniority on contract work, and that is a sign of dry rot. That is to say, when a man has worked for the company a long time and a sub-foreman is wanted, the old hand is picked out. Very good on paper, but a younger man, with lots of go, will often accomplish twice as much as a man with twice the experience but without the proper amount of assertiveness.

If you have a good, smart drill runner in a gang in a tunnel heading who keeps his machine in good shape and who sees that no one takes his machine or takes away his tools and generally sticks up for his rights, then keep your eye on him for he will make a good "heading foreman," bye and bye. I do not refer to the one who is argumentative and scrappy all the time and has innumerable rights and who is always fighting with someone about something. Certainly not that one. Such a one have I booted over the muck pile with a gentle reproof and an abjuration to get busy and sin no more.

Neither am I throwing stones at the experienced man. Far be it from me, to

say anything about the man with the first hand knowledge, but, in spite of this, the young man with what is technically termed "the punch" is the man for the foreman's job. He needs all the experience he has to hold that job, and he will get an amazing lot more experience during the first few weeks of his holding said job, more especially if it is in some sections of this continent. His gang will very painstakingly attend to his education for a time, at least.

Once you get a good foreman, do not spoil him. There are several ways of spoiling, one of which is to say very airily, "Now, it is all up to you, sail in," and then go up in the office and read the "Rodman's Dream" or the "Shooting of Dan McGrew." Your foreman needs a lot of guiding at any time for it is only about one in a hundred that has brains enough to handle his job without any aid or suggestions and this one does not stay long as a foreman.

It is "up to" the "walking boss" and the superintendent to keep a close eye on the foreman, whether a new or an old one, and put in a word here and there to keep things straight and to expedite matters. If you leave him entirely alone, he will get the idea that he is doing fine, and if he is and you still keep him, he gets swelled up so that you have to enlarge the office door when he comes in for his pay check. On the other hand, if he proves to be a poor foreman, as he has every chance of doing when let alone, then you "fire" him and he goes away firmly convinced that you have a grudge against him and will make a mighty poor foreman thereafter, unless someone else breaks him in right.

Another matter that is liable to cause trouble is the hiring of men. Your foreman wants to hire his own gang, and to a certain extent it is well to let him do it, but I have seen foremen who would require two employment offices working three shifts a day to keep them with a gang of twenty-five men. So it is the business of the man higher up to keep his eye on that matter. The foreman is also liable to be somewhat elemental in his methods of judging a man.

It has been known that certain foremen objected to men because they dressed, and I know of some "walking bosses" and any number of foremen who had a very strong antipathy to dudes. All persons coming around looking for a job with a clean shirt on were classified as dudes. I recall, also, the sad fate of the hobo in the grading camp in Colorado who was "fired" because he ate peas with a fork. Wherefore, be it known that it is well for the superior to take a hand in the picking of men.

Another peculiarity about foremen is that they have a deep seated objection to doing any clerical work. Right here is where I get all the cost-keepers, time-keepers, economists, and keepers of the great seal after me with a sharp stick. However, I will persist for it is an indisputable fact that a foreman would rather do an hour's extra work than make out a report that would take but three minutes. Furthermore, and again, and moreover, if you persist in having him make out any reports, you may as well burn them for they will not be of much use to you, both as regards reliability and legibility, and you had better also have your eye out for another foreman.

I have heard many of them growl and make remarks about making out long reports after you had finished your work, etc., etc., and they do not like it. The reason for this sad state of affairs, I do not know. It is not lack of education, for I have seen many a graduate C. E. or M. E. cuss these reports just as earnestly as some unlettered alien. I have also seen these same C. E.'s and M. E.'s in later years, when they were superintendents, dictate concise reports to a stenographer, which were models of clearness and brevity.

Possibly it is because the foreman has little chance to carry a fountain pen or pencil in his "panties" while engaged in his pleasing occupation of hustling a gang of men concreting, mucking or otherwise disporting themselves. Perhaps, again, it is something that goes with the job. I myself think it does, so let it go at that for I have not as a general rule had any success in getting foremen to do any clerical work except to sign the pay-roll or send in an order for more material. Anyway, as the consulting engineer says, "it is immaterial," and it is far better and cheaper to have someone who is trained to do the clerical work.

Do not tell a foreman more than a dozen things at once. Lay out two or three days' or a week's work ahead of him, and then if he wants to know more, tell him; but, if you unburden your mind of the whole scheme relating to his part of the work from start to finish, he will not be able to take it in. Get him to understand sketches and blue prints as it will help amazingly and broaden him out mentally.

Do not let him give you any foolish estimates on how soon he is going to finish a certain job. Many foremen have the habit of telling you that they will have a certain piece of work done days or weeks before they can possibly do it. Some do it to cheer you up, others because they are trying to fool you, and still others because they do not know any better.

If they do it for the first reason, I personally try to impress upon them the fact that I am naturally cheerful and do not need artificial stimulants in that direction. If for the second reason, I impress it more forcibly on them that I have as good an idea, if not better, than they have, of the length of time required, and if for the third reason, it is time to go after them and educate them to estimate the length of time required. This optimistic guessing business is not restricted to foremen, but many superintendents indulge in it, and the answer is always the same.

In speaking of the advisability of keeping an eye on the foreman, I do not mean that it should be done by a method advocated by a well-known contractor. His idea was to have a tower erected in the geographical centre of the work, wherein were located men with telephones, megaphones, field glasses, etc., and from here the work was directed. He had not settled how the poor foreman was to get back at the wielder of the megaphone when he had an answer to give or an objection to make to the orders received. Neither did he state how this method was to be used on a piece of work of which I had charge in the West which covered a territory of twenty miles one way by nine miles the other, or a job in Mexico where the line of work was thirty-five miles long. Possibly a wireless telegraph system would be used there.

Another thing, and a very important one, is to watch sharply to see that your foremen do not have favorites in their gangs.

The Laborer.

In running contracts, especially where large numbers of men in various lines are employed, it is very much "up to" the parties in charge of the work to go forth into the highways and byways and gather up the men best suited for the work and to the general conditions, taking care that they go where the right kind of men are to be found. It is much cheaper to get men who are expert in the various lines, pay them more and even pay their railroad fares than to take men who are unfamiliar with the work in hand and try to break them in. It means not only time lost in teaching the men the work, but many of them never become proficient or efficient in the various lines of work into which they have been shoved.

This looks like a perfectly plain proposition and to casually glance over the matter an intelligent person would say, "Why, of course, no one but a fool would try to use men for tasks for which they are totally unfit." It is a strange fact, however, that if you go on work that is handled by some of these before mentioned intelligent people, you will find in some cases just the condition mentioned.

For instance, in some of the coldest regions of the United States and Canada you will find contractors trying to do work with men from warm climates like Southern Italy and Greece. These men, unused to such a rigorous climate, either underdress themselves and, as a result, have a very low vitality and are, consequently, of very little use, or overdress and move around like wooden men.

The excuse is that they are the only available labor. To be sure, they may happen to be the only ones obtainable at the moment in large quantities. Only by carefully sorting over the men and getting the ones best suited can you get an efficient force. I have seen on the work of many wise people a gang of Armenians, Greeks, or Italians trying faithfully to handle heavy timber, to put up derricks, etc.

There is perhaps no more awe-inspiring sight than to watch a gang of Greeks, each possessed with a peavy having a very long stock, (they always send them that way to amateurs), trying frantically to spear, hook or to otherwise maltreat one very round and very slippery log in an attempt to get it to a desired spot. Or say, two Armenians violently pushing toward each other on a cross-cut saw, thereby causing same to jam. It is not known or appreciated by some, that in these things as well as in many hundred others, there is what the artists term "technique."

If anyone doubts it, let him compare the above instances with a gang of "river hogs," handling logs for a crib dam on a river in Canada, Maine, or Wisconsin or a crew of "lumber jacks" cutting and hauling logs in the Michigan or Canadian woods. That is where true efficiency comes in.

Possibly, there are learned persons who contend that any man can handle such rude tools (or weapons) as picks and shovels or cant hooks and axes. In such cases, they contend wrongly, however, for there is in all cases, much skill in the handling of such things by a man who knows how to use them. And, to be sure, it is a pleasure to watch men who know how to handle the tools or machinery that are given them to use. At the same time, it is a fearsome sight to see a novice trying to make you think he can use them.

It has been said that all a man on construction work needs is a strong

back and a weak brain, but I have come to the conclusion that about three quarters of a man's ability to work lies in his brain. To any healthy, able-bodied man who thinks it does not require considerable skill, nerve, and experience to do these simple stunts on a construction job, I will be glad to prove he is wrong by giving him an axe or a cant hook and putting him in a gang setting crib cofferdams in quick water with a 200-foot drop a hundred yards down stream, and where men do not yell at each other to "look out," as they would not hear it, and, besides, it would be too late anyway.

Then, I would make him one of a gang of twelve men who had to load seventy-five one-yard cars of muck in a tunnel in seven hours and do it every day. After that, I would nominate him for the position of "bucker up" on the thirty-fifth story of a steel building where all he would have to do would be to hold a dolley against the head of the rivets while a man with a pneumatic "gun" on the other side did all of the work. Next, for a vacation, I would take him down in a caisson under say 42 pounds of air where all he would have to do would be to help load about one hundred buckets in eight hours, help to clean out under the cutting edge, and do a few other small chores. By that time, I think the verdict would be that there is certainly something more to it than appeared at first.

Efficiency in construction work, I take it, is the using of the various forces in the most economical way, or the getting of the maximum output for minimum expenditure. To get the maximum output from a man, you have to utilize human nature and not combat it, and that is the point where the theories get mixed, where the stop watches get out of "whack" and things don't equate. The reason is very simple and easily seen.

A man is not a machine, that is all there is to it. Because one man does a certain amount of work, it does not follow that six men will do six times that much. Maybe they will if you watch them, but the chances are sadly against it and it is a certainty that they will not keep up the gait. Our little stop watch will tell us that one man makes certain motions in certain times, and observation tells us that that man shovels more than any other in the gang. Hence, you should have all others make the same motions and then they will shovel as much as the horrible example. Looks easy, but pull it apart and see what is inside.

First, let us go see the baseball game (probably most of the readers have gone before this). Anyway a big league baseball team is a highly efficient machine and they do things in seconds and fractions thereof. Take the catchers on say six teams, you will see that there are probably no two catchers who throw the ball to second base in the same manner. Pick out the fastest ones and you will notice, possibly, that they throw flat footed. That is, they stand right in their tracks and throw the ball a fraction of a second after receiving it, while others have to take a short step or a hop to throw. It should be very simple to have them all throw flat-footed. One little thing prevents, and that is that it is physically impossible for some to throw that way. The same thing occurs on your work.

The next item is, as before stated, the handling of human nature. Two and two do not make four; they usually make three when men are concerned. If one man does so much, ten men will either do less than ten times as much or considerably more. If the former, it is the usual average; if the latter, then you have a genius bossing the gang (which is not uncommon).

Another sticker is that the men know they are not machines and object to being treated as such. If you know how to handle men, you can take ten men and by elimination and substitution you can get together ten men that will do team work to an amazing degree, and ten medium good men working together in their own way will do a large percentage more than nine men, however good, trying to work in an unnatural way, and one man working in his natural manner.

You can adjust a machine, so that it will make certain motions and accomplishes certain things. It is impossible to adjust men. You have to take them as they are, and you can train them to a certain degree, but when you reach a point where your ideas conflict with the other man's ideas, you are liable to come to an abrupt stop. Therefore, it is necessary to allow about seventy-five per cent for contingencies.

Again, it is not uncommon to find several men accomplishing the same result in very nearly the same time and with an equal amount of labor although their methods may differ considerably. Now taking the quickest method, you will find an astonishing number of times that it looks to be the hardest method, in the amount of work to be required. Then, with, say, six men doing the same thing and all accomplishing it in different ways and in slightly varying lengths of time, you will find by trying to have them all use a uniform system that you get seventy-five per cent efficiency out of five of the men, where you got ninety or ninety-five per cent before.

In other words, it is not the motions a man goes through with his hands, but the motions he goes through with his brains that count. To find out about the latter, you have to get acquainted with him severally and collectively, and that cannot be done with a stop watch and micrometer calipers. Furthermore, this business of segregating men so as to gauge each man's output, is chiefly lost labor. If you have a gang that you have to keep track of that way, it is better to pass them a time check and start over again. Team work is the whole proposition.

Take, for instance, steel construction. In a riveting gang, you have four men. The gang drives five hundred rivets a day. There is no way of telling just how many rivets each man is responsible for because each one is good at some particular part of the work and the whole gang works as a unit. If the number of rivets driven decreases, it will be found in seventy-five per cent of the cases that it is rather because the "bucker up" and the man with the "gun," or the heater and some of the others do not agree, and slang each other villainously and thus lose time, or purposely do things to aggravate each other, than on account of the poor efficiency of a certain man on the team. Lack of team work, you see. Take our baseball team again. Why is it that a collection of remarkably brilliant stars cannot play as well as a group of mediocre players who work together? Team work again.

On construction work, the team work consists in finding out what particular niche a man belongs in and putting him there. There are exceptions to the above and that is where the work consists in a lot of small units such as, for instance, those of several blacksmiths each sharpening drill steel. There each man handles a certain number of pieces, each like the other, and the next man does the same. Even then the results will depend a lot on the team work of the blacksmith and his helper.

As to the efficiency proposition, in ninety-nine cases out of one hundred, it will be seen that the improved results are not in the men at all but in the way they are arranged, the way the plant is laid out, the way the material is moved to them or away from them, or a dozen other similar things that otherwise cause delays. My experience is, that if you get material to and from the gangs quickly, you can work them to their limit all day.

For instance, when handling muck from a tunnel, if there are always empty cars set in before the last are quite loaded, the gang will speed up to meet the needs. If there is a lapse of a minute or two between cars, the gang will stand up, stretch, light their pipes and get relaxed. Then they have to get up steam again.

The situation is the same as that of a locomotive that stops and starts every few minutes. Energy is wanted and time is lost, while if it ran continuously, it would show a saving in fuel and a greater speed. Of course, it will be said that a man can not keep going at top speed all day. Possibly not, but the man does not need to if the gang keeps going at top speed. Each man has certain things to do, and he finds at times that he will have a few minutes to wait or that he can slow down at times with his part of the work, while at other times he has to speed up to keep pace with the other work. Besides that, by working men a shorter day, we can pretty nearly count on full speed all day.

I have in mind one example where the men worked nominally ten hours, but actually put in anywhere from twelve to eighteen, getting paid overtime. The result was that they were "dopey" all the time and could not hustle even though they wanted to, and the contractor was really getting only eight or nine hours' work out of them while paying for twelve hours. I know from actual experience that an efficient gang will do pretty nearly as much work in eight hours as they will in ten, and do better work.

As before stated, it is well to watch the mechanical part of the work and when you have adjusted this to your satisfaction (if you ever do) you can amuse yourself by making motion studies, etc. The chances are, however, if you do get started on that, the mechanical end of the job will fall apart again. Do not misunderstand me, when I say mechanical. I mean everything that is in use on the work outside of the men. A wheelbarrow is a mechanical contrivance (or contraption) and there are a number of points about a wheelbarrow that will be of more or less interest to you, as anyone can testify who has fallen over one in the dark.

I remember one man who maintained that a wheelbarrow would knock you down and jump on each part of your anatomy at the same time. While I would not go so far as to say that, I do say that it will bear watching. Fix your runways so that a man will not have to be a tight-rope artist to get along them and said man will reciprocate by wheeling considerably more

material along them. Butt the ends of the planks together, or put inclined pieces from one plank to the other, where they lap over each other, and do about a million other things. Do them all before you go meddling with the man's internal economy and remodelling his scheme of architecture so he can do things in the way which you think is right.

It is quite possible that the man's idea of the proper way to do things is as good as yours. His method may not look artistic, but, after all, the test is not in the way he does his work, but the amount he does. I have found it well to forget methods and instead keep my eye on results.

When you have a gang of men which are not doing the proper amount of work, you will usually find that either the cause is entirely apart from the men or else it is in their mind and not in their body.

The Camp and the Food.

Next to having all tools and appliances in good order and working smoothly, the most important thing is to keep your men reasonably satisfied. To keep them entirely satisfied, is something that cannot happen this side of the Great Divide.

Some contractors do not place much importance on their camps. As long as the men are under cover and get something to eat, they do not look any further. Others have an idea that they are looking after their men magnificently and are led to this conclusion by the fact that the board runs from seventy-five cents to one dollar per day per man. That is nothing to go by as I have, occasionally, been boarded better for fifty cents per day than many times at seventy-five cents or more.

The average company doing their own work and many contractors throw up a camp, get a man who says he is a cook and turn him loose on the unsuspecting men. The average "rough neck" has a leather lined, copper rivetted stomach and he surely needs it, for some of the mixtures handed to him to eat, and on which he has to do his eight or ten hours' work, would corrode the tubes out of a boiler or clog a gyratory crusher. The pity of it is that there is no need of it.

Many of the camps of railroad contractors doing double tracking or grade revision work in the West and Middle West are models of what camps should be as regards food and cooking and economy. The same is also true of the camps of most of the different boarding companies, who, I may explain to the uninitiated, take a contract for feeding the men for so much a head.

I have seen cooks working for a boarding company at wages of $125 to $150 per month, with plenty of assistants and waiters, and have eaten meals in camps of which they had charge that would make you think of the sort that mother used to make. These same meals cost a lot less than in many places where the food was not fit to eat. These men had everything they wanted to work with and their kitchens looked like a kitchen in some big New York hotel rather than that of a construction camp.

The things they have and the amount and pay of the help would make a number of big contracting firms gasp in astonishment They would say a superintendent is crazy if he started an organization like that to handle his commissariat, and that it is absurd, too expensive, unheard of and generally against all rules and regulations and contrary to the U. S. Constitution and the Magna Charta. I know they would, for the simple reason that some of them have said so to me.

Nevertheless, the aforesaid boarding companies have never been accused of being in business for sanitary purposes entirely. It is even rumored that they pay a pretty fair return. The trouble is that the majority of Eastern contractors have an idea that anyone can run a camp and, therefore, they hire anyone who comes along to look after that part of the work, or in a number of cases, nobody runs it. The cook tells the superintendent what he wants and the superintendent forgets it, which is a very simple system to look at, but hard to work.

When the food is poor or is badly cooked or served, the men become dissatisfied and the contractor wonders why he can not keep men. I have known men to walk over a hundred miles of line to get to a camp that had the reputation of feeding well. I remember one man in California, whose nickname was "Hungry," as his camp was the poorest in food along several hundred miles of railroad. He reformed partially but the name and reputation stuck; and, as I was carrying on some work near his contract, we profited by his bad name, more especially as on that occasion I was the proud possessor of an efficient commissary and cooking organization. It takes specialists in that line as well as in anything else.

I cannot pass this subject without making a few remarks about one piece of work in Canada with which I am familiar and which is a beautiful sample of how a camp ought not to be run.

One cook and a cookee handled the headquarters camp of six to eight men. Another cook and several cookees attended to the main camp of about sixty men, including foreman, mechanics, etc. The board at both camps cost considerably above what the company could possibly charge the men for it and on the average it was about seventeenth class or worse.

One man was a combination timekeeper, bookkeeper and commissary man, and usually the food proposition was so bad that it would have been alarming if it had not been so funny. For example, they bought beef on the hoof and the master mechanic and the "walking boss" were sent out to buy it. That sounds like a joke and it was, unless you had to eat the beef.

On one occasion, they bought what they considered a fine fat steer. It was, and the next day after they brought it in, it was much fatter than before and in fact got to be the great "granddaddy" of all fat steers. Then they found it had dropsy, or whatever disease corresponds to that in cattle. They kept it around several days trying to cure it so they could kill it for beef. I was greatly interested in that steer. I was so solicitous about him that I called on him every day to see if he was still alive. Finally, his condition became serious and they disposed of the poor fellow, and I was relieved, although to this day I do not know whether he appeared on the table or not.

This same work was nine miles from the railroad and about thirty from quite a large city. The people in charge kindly bought fresh fish in the city once a week and it was sent by freight. It left the city Thursday or Friday and we had it for dinner Monday, if there were no breaks in the schedule or if the train was not delayed. As a consequence of this mis-management, the men left in droves and the contractor never seemed to catch on that there was anything wrong with the food question and resented the slightest hint in that direction.

The manager of the construction company got to the work about once a month, and if he had time, would stay to dinner, whereupon the cook would, of course, do his very best. He would get a chicken, or other fowl, manhandle it, cook it, and serve it on the table, looking as though its taking off had been by way of a boiler explosion or through an automobile accident, on account of its mangled condition. The "Boss" would expand his chest, tell us we were living like lords, eat a quarter of a half portion of the deceased bird, get up from the table, and then "beat it" madly back to the city, there to eat enough dinner for four men that evening at the best hotel in that section of the country, after taking something in the nature of a restorative and invigorator to counteract the effects of his noon meal.

As I was an outsider, I merely picked out the least damaged portions of the remains, ate my meal and restrained my desire to smite the gentleman when he sprang his remarks about our high living. This is, to be sure, an extreme case, but it is true to life and the result was that the completion of the work was delayed weeks and even months beyond the allotted time with consequent loss of several thousand dollars, both by the contractor and by the owners of the property.

The contractors admitted that the delay was in a large part due to their inability to get men, which, I wish to remark right here, ought to cause any sane person to shun the aforesaid contractors, as the performance of their whole contract hinges on their getting men. A contractor or a superintendent who cannot secure men, and lots of them, at any place and any time, is about as much use as a safety razor at a "coon" picnic. To return to the subject, however, these people ascribed their inability to get or to keep men to any and all causes except the right one.

Another feature whereby the men may be kept in line, is the matter of providing good bunk houses. By that I mean water-tight, weather-proof ones with space enough for the men to change their minds without going outside. If you furnish the bedding, it pays to put springs in the bunks. Also, it is not wise to build the bunk houses too large. Make them small, and the various nationalities, factions or classes will separate and live by themselves. Then in case of a fight, you do not get very many killed. If you build these houses large, you will be obliged to station a strong-arm squad in the building armed with knuckle dusters, black jacks and riot guns to keep anything like as much order as prevails at an Anarchist meeting, to say nothing of peace and quiet.

On one job in Mexico, I had a dozen camps from one hundred and fifty to five hundred men. I requested our employment agent in Mexico City to send three watchmen for each camp. Four of the camps were composed mostly of tunnel men from the United States, they being Englishmen, Negroes, Polacks, and Austrians.

The three watchmen divided the day into three eight-hour shifts and it was the day man's business to look after the camp sanitation and the night men's

business to keep things reasonably quiet. At one camp, the three were not holding their own and the men chased them out of the camp. At another camp, I had a chance to watch how they managed things. They arrived the day before pay-day and had an easy time that day. The next day two of them resigned suddenly and left, going fast in a northerly direction. The third was the kind I wanted. I gave him the four to twelve shift and told him to have things fairly quiet by 10 P. M. He did; he had them all in bed, stopped all gambling, took about a bushel of pistols away from them and had the lights out at ten.

He found some of them at a "cotina," or native bar room, and as the proprietor stood on his rights as a free citizen of the glorious Republic of Mexico and refused to be jollied, coerced or otherwise persuaded into closing, the watchman chased all the customers out, closed down the board screen in front and nailed it down and then gave the publican to understand that he was the watchman and a bad "hombre" and that the little gin mill was to remain very tightly closed until "manana." This man was a diplomat first and a fighter afterwards. He got along well with the men and still kept order.

Finally, after you have fed your men well and put them in a comfortable bunk house, leave them there. Do not go around their houses unless you want one of them and do not bother your head trying to entertain them, or start free libraries, or give them free lectures on hygiene, or organize glee clubs.

They most emphatically do not wish to be entertained. They will attend to that in their own crude way, usually by "shooting craps," playing poker or by other methods not generally approved by moral uplifters.

But, remember that these men are rough, tough and hard to handle, and if they were not, they would not be doing work on a construction job. If you want moral uplift, hire some one else for the job while you run the work. This for two reasons, first, because from close observation I have grounds for believing that either contractors or superintendents are not a howling success as moral uplifters, especially on their own work, and second, because each job is a full man's size all by itself.

The men feel very resentful towards anyone who starts in and makes a business of amusing them or otherwise bothering with them outside of working hours. Personally I cannot say that I blame them as I would feel the same way about it. They object to any person, however well meaning, breaking into their spare time and trying to interest them in things they do not care about.

Once upon a time, I had arranged to take charge of a construction job for a contractor of somewhat pronounced ideas on certain things. He and I had a long conference at his house and he had many startling innovations to try out and his wife had a schedule all drawn up of what she proposed to do towards giving the social and moral uplift scheme a whirl. She had a programme of entertainments, lectures, etc., and was going to establish all sorts of institutions for "hubby's" men.

She was a fine woman and it was great of her to want to do something, but she was "in the wrong pew." I could see where she was framing up a heap of trouble for both herself and me. However, as luck would have it, the company that was to have the work done could not finance the scheme at the last minute, and four or five thousand hoboes will never know how near they came to being regenerated.

On the other hand I once had charge of the construction of an addition to a steel plant in the West, where they employed three thousand men in the plant then in operation and would employ nearly as many more when our work was done. They had quite a number of accidents every week and the company maintained a very complete hospital near the plant and that hospital was handled entirely by the president's wife and it was handled in a business-like and, at the same time, humane manner that made it a model of its kind.

That lady had the right idea, and she knew every person that had passed through that hospital since she had taken charge, and all about them. Which reminds me, that next to a good cook and good food, the best investment that can be made is a doctor. Not an imitation one either, but a real one. With a good physician and an efficient superintendent, a contractor can carry his own accident insurance and make money on it especially in these days of high rates. Also, if the work is of any size, a hospital is a very necessary adjunct.

Accidents: Causes and Remedies.

The question of accidents is also a stumbling block over which many a contractor has broken his financial toe. While public work is of such nature that there will always be accidents, still about ninety per cent of them can be eliminated by careful inspection of all the plant every day and by carefulness in the various operations which should be seen to by those in charge.

On one contract in Ontario, there occurred two bad accidents both caused by the dropping of derrick booms. In one instance, lightning struck one of these derricks and ran down the cables, burning them and drawing the temper. The next day the boom fell the first time a load was put on and killed two men. If a man had gone over the derricks and inspected and oiled them every morning or evening, the trouble would have been noticed as it showed up quite plainly.

The other accident was caused by one of the foremen hitching a chain to a heavy brace and trying to pull it out. One of the links at the mast head gave way and the boom fell, killing the foreman and injuring two other men. In this case, the man in charge should have been looking after such matters, for if he had always done so the foreman and the engineman would not have been taking fool chances.

There are, to be sure, many less accidents on public works, than many people think. Part of the general public does not think about it at all, and the other part thinks that every construction job is a veritable shamble. This latter idea is helped along by some budding or blossoming author who is looking for throbs, said throbs to be incorporated in an article for a popular magazine or Sunday supplement at so much per line or folio.

One article of this kind appeared some time ago entitled "Just Wops." It was extremely thrilling and very harrowing. The writer of the narrative went over to the "Jersey side" and discovered the Erie Cut. He also discovered some young engineer who, upon finding that the author was easily led, proceeded to fill him up. Kill men; sure they had killed several score, were killing them every day. Unfortunately, they were not killing any that day, but they might have a few new killings on hand soon, so he had better stick around. Upon the author's asking this truthful young man whether his conscience did not smite him at all about this needless slaughter and whether his soul did not shrivel up appalled, he replied with nary a shrivel: "They are 'just wops.'" Hence the immortal title.

The innocent author being unfamiliar with the fact that the word "Wop" is the technical name for the subjects of King Humbert, proceeds to tell us what the word means and gets his cables crossed badly. He elucidates that laborers, "sand-hogs," structural iron-workers, and in fact, any man employed on construction work is a "Wop." He is, eh? I should love to be around when he called some "sand-hog" from East Boston, some iron-worker from Buffalo or some Negro drill runner a "Wop." There would be something doing, I guess.

Anyway, the writer of the thrill proceeds with the agony and hints darkly that the young man did not tell him all about the dead ones and that there were doubtless many more. They used them for back-filling, no doubt. He, furthermore, states that it is a historical fact that there is a fixed rule of structural iron-workers that one man must be killed for each floor of a sky-scraper. He does not say whether they "scrag" them one at a time or wait until the building is completed and then push them all off the top.

Foolish articles like this would make very little difference except that a lot of otherwise intelligent people believe them and, unfortunately, some engineers foster that belief and like to strut around and tell how many were killed on the last job.

The bright gentleman who wrote the article in question did not get the case of the man whose leg was pinned down by a boulder too big to lift and how the other men propped up the boulder and the company doctor crawled under it and amputated the man's leg in an effort to save his life. I myself have on several occasions seen a superintendent or a foreman, when there was a blow-out in front of a shield in a tunnel, go down in front and pull out Italians, or other laborers who were caught in the first rush of mud or sand.

There are, as before stated, cases of carelessness, and contractors and their superintendents should see that all due precautions are taken. Then it is a business matter, as men, and especially the best ones, are mighty shy of work where accidents occur, especially where they are caused by carelessness. Being good men, there is no trouble about their getting work, so they leave the careless man's job and he gradually acquires a gang of the more stupid or reckless ones. He then has a combination that is like a lighted match in a gasolene tank.

My experience is that nine-tenths of the good men who are on construction work will take chances that would make people's hair curl, when it is necessary and they know that it is, but for all their seeming recklessness they have a sharp eye on people and things. Therefore if they find that they are risking life and limb every day just because someone is a plain fool, they will suddenly move along. And, as a consequence, the work suffers. By the same token, it pays to stay with your men when anything happens. If you do, they will

stay with you when you need them and do it sometimes in a way that is worth going miles to see.

Workmen Under Trying Conditions.

As many know, the common or garden variety of "rough neck" is a pretty tough proposition, but there are no sandier lot of men anywhere, taking them in bulk, and my hat is off to them. They built the railroads all over the world, they built the canals, tunnels and bridges and are building more, and I have seen some of them in places where it was not good to be and where they had to set their teeth and fight it out for life or death, and there was no crowd cheering for them. Some times they could not speak the language of the other man or men who fought with them. Then again, I have seen them fight as if for their own lives when it was only their employer's property they were trying to save.

One of the very last operations on the building of the Buffalo Water Works tunnels was the sealing up of the bottom of shaft No. 3. To do this, a concrete bulkhead was built in the shaft with an air lock in it and it was kept under a pressure of 42 pounds of air. This pressure was not only on the shaft, but also on 250 feet of the lake tunnel as well as the whole 4,700 feet of land tunnel. This latter was stopped off from the shaft by two gates which had been lowered and under them ran two twelve-inch pipes for drains.

While working in the shaft bottom, the pumps, which were located just off each side of the shaft in chambers in the rocks, were run by steam. This made it unbearably hot, more especially up under the bulkhead near the air locks. Even down in the pump chamber, the temperature was 135 degrees Fahrenheit.

The instructions were to always have at least two men inside the lock. One evening at eight o'clock, when the four o'clock shift came out for lunch, there was a new pump man on duty, and he followed the gang out to get oil for his pumps, leaving only the lock tender inside. This man evidently, after taking the lock back in, started down the ladder leading to the bottom of the shaft and fell, striking his head and killing himself.

After spending an hour trying to attract the lock tender's attention, it being thought he was asleep, efforts were made to get inside. If matters were let go, it was only a question of time when the one pump, which was running, would either break down or stop for lack of oil and the tunnel would be flooded.

First of all, we tried to get through the air locks at the next shaft on the land tunnel, stop the 15-inch drains under the gates and then blow the air off the shaft to get in as that could probably have been done before the water drowned out the pumps which were located six feet above the tunnel grade. It was found, however, that the last man through that lock, which was not expected to be used again, had tied the outer door very nearly shut. The inner door leaked just enough to allow the air pressure to close the outer one. At the same time, the lower door was prevented from falling completely open by a rope.

The next thing was to wedge open the outer door far enough so that the air rushing out would catch and close the inner door. The upper door was wedged open about four inches and we then had to desist, for if the lower door had been forced shut with the amount of air that came rushing out under 40 pounds pressure, the changes were that the shock would have driven it clear through. The upper door was, therefore, allowed to close and the gang went back to the other shaft. There it was finally decided to wedge open the upper lock door, have a man go into the lock and close the lower door, thus opening the lock. Then there commenced an exceedingly interesting period, and I had a chance to see the festive "mucker" in action, when things were going against him, and when he had to step lively to keep living at all.

All the blow pipes were open, but this reduced the air very slowly, owing to the large amount in the tunnel, and the door was wedged open when there was still 31 pounds of air on the shaft and tunnel There was no need to call the roll and ask for volunteers.

I was standing on the stage at the top of the lock with two foremen and five "muckers" when the door came open and two of the latter jumped for the lock. One reached it and the air coming through the door struck him with such force that he was literally blown back across a brace like a wet rag. The second man dropped on his face, pushed his feet and legs down through the door and gradually worked toward it. When he felt the ladder with his feet, he straightened up, but his body blocked the door, which was only 15 x 18 inches in size and the air going up his trousers ripped his clothes to ribbons and forced him out again. A third man tried it with the others holding him against the air pressure and he got down with his shoulders level with the door when the air blew up his nostrils with such force that it nearly strangled him and distended his cheeks like those of a chipmunk with a mouth full of nuts, so he had to back out.

By means of signs and a few kicks, I conveyed to them the idea that they were to wait until the pressure went down some, which they did and a few minutes after we tried it again with one man going down head first, after the fashion of a man diving, so as to keep the air from going up his nostrils, and at the same time we fastened a rope to his leg so as to keep him right end up, or wrong end up, with care. We lowered him down to the bottom of the lock, shut the door and the trick was done with the gauge at the power house, which was piped directly back from the tunnel, showing that the air had not gone below 19 pounds.

The minute the bottom door of the lock was closed, the pump man tumbled into the lock followed by a foreman and two muckers and they were in through while I was telephoning the power house to run the air up again. When I went inside, they had all the pumps going, and while I do not want to get in the "just-arrived-in-time-class," I wish to state that if we had fooled around with our air lock five minutes longer, we would not have had a tunnel to go into, unless we used a submarine.

The worst was yet to come, however, for after the water was pumped down and we had found the dead lock tender, the problem was to take the body up 60 feet of perpendicular ladder across a stage and through a 15 x 18-inch lock door into a 30-inch diameter lock stood on end with nothing to stand on but the rungs of a ladder up one side, accomplish this in 42 pounds of air in a temperature of over 135 degrees, and, finally, get the body up through the lock and the upper door and up another ladder for about 20 feet to the surface.

Taking it all together, I do not ever recall putting in such a strenuous hour since I was born, for it took us that long to get the body up into the lock. Then I sent the lock out with the body and five men and it was necessary to use the derrick and pick up the five live ones and the dead one out with the lock and land them on top.

Now, this may not prove anything to some people but it did to me, because I was most emphatically among those present. First of all, in the two gangs that night, for the twelve o'clock shift got around before the lock was opened, there were two foremen, one English and one Polish-American; a master mechanic, American; two pump men, one Canadian and one Yankee, and about twenty "muckers" who were mostly Polish, but partly Irish-American, native Americans, English and Negroes, besides outside men and hoisting engineers, and they all stuck to me just as a matter of course,

Secondly, they did not wait for anyone to go along ahead to see whether everything was all right, but when they knew what there was to do, they went at it just as though it was all in the day's work, which it was; and, finally, when they were hard pressed, they showed that they could think pretty well, since they tried some schemes that required a pretty level head to think out in the excitement, and with the air blowing, the noise was so great that it was deafening.

These men did not go home and tell the neighbors about it. They simply went back to work and finished their shift. As a matter of fact, I would not go through that night again for a million dollars and I would not have missed it for two million.

These same men look very uninteresting and no doubt are to some people, but they are a study all by themselves even when they get in some peaceful hamlet on pay-night and proceed to pull it apart to see what makes it go, and I freely admit that at such times they are a fearsome sight. However, even such a situation as that, is susceptible of being handled, if you have taken the trouble to previously take note of the habits of the men and have got acquainted with them.

I have taken men from Michigan to California, from Quebec to South Carolina, from New York to Central Mexico and do not recollect ever having lost any of them or had any get into serious trouble. Chiefly, because I do not only know the men, but know the men I sent to handle them, and these latter kept them from derailing the train or devastating the country, although there are certain villages that date their calendars from the time they went through.

This same business of shipping men is another thing at which many contractors, of what they are pleased to call an economical turn of mind, throw up their hands in horror. They will give you about one thousand reasons why men from Maine can not work in California, or vice versa. As a matter of fact, if a man knows his business in Vermont, he can work at it in Texas, and, personally, I have never found any trouble in taking men about, if they are first-class men. When you do that and add to them first-class foremen, your gang will pretty nearly "land running."

I started to write a paper, and it looks now like a book, and the trouble is that the further I go, the worse I get in expressing myself, so think that I had

better make my apologies for the many shortcomings of this article and close it. It will probably appear disjointed, but the only apology for this is that I started it in Ottawa, worked on it a short time in Mexico, then later for a short time in Buffalo, N. Y., and finally finished it in the back woods of Quebec Province.

There is just one more matter that I wish to mention before closing, and that is the fact that contractors and engineers do not get together enough. I do not mean in a stiff and formal manner, although our Society is not formal by any means, but in some place where things are comfortable and where they and men in allied lines of business can drop in at any time and get acquainted with each other and exchange ideas. The Engineers' Clubs in New York, Chicago, and elsewhere are somewhat along the line mentioned, but I do not think they are broad enough in their ideas and they are too limited in their class of membership.

In getting acquainted with each other, the engineers and the contractors will, naturally, become acquainted with outside people, and that will lead to a better understanding of them by the laymen. This point never affected me, until the present craze for romances of construction work seized the popular (and unpopular) authors, and after reading some of their yarns, I felt, indeed, as though we were a much misunderstood and down-trodden class of people and that these stories were the last straw and that it was for us to rise in rebellion and slay some of the perpetrators of these outrages.

As at first stated, I am handier with the shovel than with the pen, but, at least, I can truthfully state that all incidents cited and anecdotes related herein are true and are from my own personal experience.

I am including in this a poem which was written to me, or at me, by some hobo out West. The cause of his writing same being the fact that I had given orders that thereafter the men were to be on the job ready to start work at seven A. M. and not to leave the camp for the work at that time as had been done previously. The poem was found written on a piece of paper flour sack and pinned to the bulletin board at one of the camps. I append it to show that the hobo can take care of himself in more ways than one.

Finally, I want to suggest that we get together more in an informal way and interest ourselves in interchanging ideas socially rather than in going too much into technical matters and writing papers on such abstruse matters as "The Use of Lugs on Dill Pickles," or, "An Economic Section for Wooden Legs."

The Hobo's Lament

There's a notice on the wall,
'Tis a warning plain to all
That our hours of toil are daily growing longer;
Now that "muckers" are so thick,
They are trying a new trick
To rub it into us a little stronger.

But they will sing a different tune
When the balmy days of June
Lure the "mucker" from his daily grind of labor;
Then while Mike and Pat will rest
Drinking nothing but the best,
Mr. Hollingsworth will write another order.

It will say, "We'll raise your pay
If you "stiffs" will only stay
Till we get our new power plant completed;
But our memory will recall how they used us since fall
And the ranks of labor will remain depleted.

So take warning, Mr. Super—
Please recover from your stupor,
And give us a square deal, one and all.
Then we'll stay with you all summer,
Instead of going on the hummer
And not quit you until the leaves begin to fall.

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS

Volume I —No. 2
NEW SERIES
NOVEMBER, 1913

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Published Monthly by the *American Society of Engineering Contractors*, 11 Broadway, New York City, N. Y.

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Entered as Second-Class Matter April 16, 1912, at the Post Office at New York, N. Y., Under Act of March, 3, 1879

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At a meeting of the Board of Direction of the American Society of Engineering Contractors, it was voted, that *The Engineering Contractor*, shall be the official means of communication with members of the Society and that all notices heretofore sent out in circular form will be inserted therein, and shall be considered as legal notification, except in case of emergencies.

Fig. 6
UNLOADINC SAND AND GRAVEL
KINGS HIGHWAY VIADUCT, ST. LOUIS
(See page 23)

21

THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS

Volume 1 NEW YORK, NOVEMBER, 1913 Number 2

A National Contractors Organization

The Contractor, of Chicago, in a recent issue discussed at some length the necessity of a business organization that will fight for the contractors and give them a fair chance to make a living, without having to submit to graft at every turn.

The subject is then dismissed with the suggestion that "a tentative organization of this kind could be started by a limited number of contractors, and the bureau, under a competent director would soon grow to take in the whole country." That sounds good and easy, but we believe that had *The Contractor* tried the experiment, it would be a little less positive about the job being a snap even for a "competent director."

It is a pretty sure thing that no organization of this kind will sprout into a full grown body right at the start, that is, during the first few years of its existence, and it is a safe bet that more than a half dozen years of hard work would be necessary on the part of a few men who are dreamers or idealists, to realize in a small degree their expectations. Furthermore, not much progress can be made until an association of that kind is able to advertise itself either through its own publication or through the results obtained in fighting on behalf of contractors. Even then progress will be slow without the active co-operation of the trade press.

In either case, money, much money, is needed. How is it going to be obtained?

We know that the growth in membership will be slow, which means that funds will come in likewise slowly. It may be argued that the dues might be made sufficiently large to raise the income to the degree found necessary. But then the result is to reduce the number of possible members, since most of them might not be willing or able to pay the increased fees. Even then, should there be plenty of funds, much cannot be accomplished without the irresistible backing of a large, very large, membership. Without it, money alone will not honestly accomplish the aims of the organization.

The Local Organization Not Effective.

There is abundant proof of our contention. In New York State, the General Contractors' Association has accomplished more than any other similar body. Unfortunately, it concerns itself only with the questions that are brought up in connection with contracts in that State, yet in its sphere thus limited that body has corrected many abuses, but, because of its local character, cannot be of benefit to contractors generally.

When that association was organized, the dues were two hundred dollars per annum; later they were reduced to one hundred dollars, but that is still too high to permit a large number of contractors to belong to it. Thus after four years of existence that society has a membership of only one hundred and twenty, many of which are large firms, and is composed mainly of contractors already in much better position than the average contractor to combat graft, unfairness and other impositions to which they all may have to submit again and again.

That body of contractors has plenty of money, it comprises the most influential and prominent contractors in New York State, and it is fortunate in having a secretary who is one of the most competent we know of. Yet it will take years of effort and an expenditure of thousands of dollars before real and far reaching benefits will be derived by contractors generally, who have to do business in New York State.

Why? Simply because such a small number of contractors, no matter how wealthy individually and collectively, cannot impress the people and through it the public officials as forcibly as some other organization, less ably managed perhaps, but possessing the tremendously convincing argument of a large membership.

Contractors vs. Labor Unions.

The contractors' association above referred to is at this time upholding one of its members who has been sued by a certain labor union. The cause of the suit was the refusal of the contractor member to employ certain men at union wages for unskilled work regularly done by a cheaper class of men. The association deserves to win, and probably will, because it is in the right, but does any one doubt that it would win much easier and earlier if instead of representing small membership, it had, say, fifty times as many members? That is all the more evident in a case like the one mentioned, where the opposing union has probably several hundred times as many members and, collectively, perhaps more money to spend than its individually wealthier organized opponents.

Under the present law if a contractor is accused by a labor union of violating the Labor Law, the mere filing of an affidavit with the Comptroller stops all payments until after an investigation is made. Such investigation may consume several months during which the contractor is often unjustly deprived of his remuneration. Again and again such complaints have not been sustained and the penalty is so drastic that the very object of the law is defeated. Nevertheless, labor unions are absolutely opposed to any amendment of the Labor Law.

What is the result? The procedure entails so much expense that the contractor naturally adopts the easiest settlement of the difficulty—he gets to terms with the unions.

In the end the public pays the bill. The fact that the present Labor Law invites blackmail, is a very prominent reason for the high cost of most of the public works.

The Solution.

The contractors need, in the first place, the aid of the public before they can remedy this state of affairs. They must appeal to the people through publicity—that great and only scavenger of the filthy methods of grafters and blackmailers operating under the guise of a political organization. They need the help of the engineers who are charged with the enforcement of specifications drawn by themselves—specifications which are often unfair, one-sided and arbitrary. Such co-operation can be secured only through free and open discussion at social meetings where the engineer and the contractor can expose their views without the handicap of the personal and often heated aspect of the argument when conducted on the job.

Another advantage—and a most vital and important one—is that any recommendations that may be endorsed by a mixed body of engineers and contractors will command public confidence to an extent not accomplished by an association of men all of the same calling.

Which leads us to point out that the American Society of Engineering Contractors is just that kind of an organization. It is international; it is open to all contractors who have to construct or build; it is for all the engineers who are engaged in construction work whether they be municipal or consulting engineers; the manufacturers of contractor's equipment are welcomed because their material welfare depends on the financial success of their customers, the contractors; lastly, this society invites and is glad of the valuable co-operation of the lawyers who are engaged and interested in contract work, because the advice that they are qualified to give is often the very thing that will save the contractor trouble and loss

Local interests may be taken care by branches which to a great extent will be free to act independently in regard to local matters, without, however, losing the influence and impressiveness created by affiliation with the parent society.

There are so many evidences of the working feasibility and success of the plan outlined, that it is hardly necessary to amplify further.

Nevertheless progress is slow. It is difficult, very difficult, to arouse the individual to action that will not result directly and immediately in personal and material ad-

vantage. Therefore, time, much money and far more patience and devotion to the cause is needed among the pioneers before actual and lasting benefit can be realized.

In this connection, the trade and technical papers have a responsibility that they do not seem to have thoroughly appreciated thus far. Often enough do they point out unfairness in specifications, injustice done to contractors, graft and abuse. Occasionally, as in the case the publication mentioned at the beginning of this editorial, they urge a defensive organization against the abuse. But do they investigate the present resources in the field and give them their support? No. It appeals more to the vanity of the very human men behind these necessary, and often indispensable, publications to advocate and talk about some pet proposal with the result that progress is only retarded because of the dissemination of effort. Instead of concentration and co-operation, we have divergence and dissolution.

Scope of the Engineering Contractor

In the last issue, because of space, we referred to the objects, policy and scope of The Engineering Contractor, but being born enthusiasts, we desire to go further into the details of this great and useful publication which we are publishing co-operatively, to further the objects and aims of this society, and for the benefit of the engineering and contracting professions.

Judging from the complimentary letters which we have received from members, to say that our first issue has been a success, would be putting it mildly. It is evident that the possibilities for the development of an organ of this character are exceedingly good.

Read the following letter, one of the many which has been received from members, which we insert here, not because it is the most enthusiastic, but because it covers the scope of the publication most thoroughly:

Dear Sir:—In the following letter it will be my endeavor to give my honest opinion to the best of my ability, of the new number of The Engineering Contractor, for October, 1913.

Being the first object to catch the eye of the casual observer, I will treat the cover first. It is the very essence of simplicity itself and in this simplicity is its great attractiveness. It sets forth in clear, concise and bold outlines just what it is intended to represent and nothing more, and in this respect, in my opinion, surpasses any of the other technical papers published.

Now as to its interior or subject matter, I think The Engineering Contractor is to be highly congratulated on confining its material to paper or discussions on live subjects of interest to the contracting world, giving the views of competent engineers and contractors from which the general coterie of engineers and contractors, can glean some very helpful suggestions that may tide them over difficult situations.

I wish to state very emphatically that the essay, as your editorial rightfully calls it, is the best of any technical writings I have had the pleasure to read, as it is so full of the true construction camp ring that it touches the warm spot in the hearts of us, who have been "up against the real thing," as the slang expression goes. Its simplicity and manner of presentation, full of humor and instructive paragraphs, leads the contemplative to view with pleasure the work of such a genius as Mr. Hollingworth, and holds him spellbound from beginning to end. Using the common expression "having been through the mill" myself I can appreciate the situations which he has so vividly pictured and gain a vast amount of benefit in reading the different manner in which the same were dealt with, and I dare say, I will not forget them and that they will occur to my mind when placed in similar circumstances at some future time and be of help to me in making some necessary hurried decision.

I intend to keep the essay near at hand and refer to it at any time I may need the advice of an exceptionally capable man, such as I consider Mr. Hollingsworth.

In conclusion let me say that if The Engineering Contractor keeps up the standard it has started it will become the leading technical paper and its circulation will be greatly increased and thus the society greatly increased in membership and consequently in usefulness and will be recognized as a leader and authority in technical circles.

With all sincere wishes for the future success of The Engineering Contractor, and subsequent increasing success of the American Society of Engineering Contractors, I am,

Yours very truly,
(Signed) W. P. Redding, E.M.

NEW DEPARTMENTS.

A few new departments will be included in this publication; departments that will be of great help to our members and that will give you a chance to co-operate with us in making the society's journal a paper of merit. For instance, there will be an

Engineering Law Department.

The Engineering Law Department which is inaugurated in this issue should prove a great boon to engineers and contractors and in this number you will find a synopsis of what we intend to do along this line.

Technical Standards Committee.

The work of the Technical Standards Committee, which is the most important of this organization, is progressing in fine shape and in our January issue we shall print in full the reports of various committees.

Current News.

We shall make every effort to keep members posted on topics of current interest, which we feel will be of value to them, and you who have real live news to impart, why not send in the same for publication.

Personals.

Under this heading shall appear each month news in regard to individuals in this society, and we shall be glad to hear from you on this point whenever there is occasion. Tell us when you change your connections, when you are awarded a contract or when anything happens in your city or village that has to do with contract work.

Employment Bureau.

This department will strive to find vacancies for those who desire new positions or are at present unemployed. It will be an assistance both to the employer and employee, and the journal shall be used as a medium for securing and filling positions. Correspondence will be treated as confidential.

Employers who have positions to fill and members who are looking for good openings can send in full particulars now.

Address Employment Bureau.

THE NEXT ISSUE

In the December issue we shall publish a paper, written by Thomas H. Ray (member), of New York, Attorney at Law, and specialist in Engineering Law. This paper was read at the regular monthly meeting of the Society, held on September 11th, in New York, and created a snappy and interesting discussion. The subject is a criticism and comment on the Proposed Revised Amendment to the General Municipal Law of New York, which the Committee on Legislation has drafted, and which was published in previous issues of the Journal.

INCORPORATION

Under date of August 6th, 1913, the American Society of Engineering Contractors, filed organization papers with the Secretary of State, under the Membership Incorporation Law. The Society will hereafter be known as the American Society of Engineering Contractors, Incorporated.

A recent article in the New York Times stated in part the objects of the Society in this manner: "The object of this Society is the advancement of Engineering and Contracting knowledge and practice, the maintenance of a high professional and business standard, the elimination of improper practices in the profession and business, and the promotion and strengthening of proper professional and business relations."

BOOST

As a final word we ask you to be a "booster," talk "Society" whenever you get a chance, and whenever you think you can interest a man in the society's good work, do so. Try to get him to fill out an application blank. Literature and application blanks can be secured from the secretary. Now "boost." This means you, not the other fellow.

Kingshighway Viaduct—St. Louis*

CONSTRUCTION FEATURES

By M. C. ANDREWS and H. M. CRYDER

Members Am. Soc. Eng. Contr.

It is highly proper that this extensive and monumental improvement of the City of St. Louis should be somewhat further *exploited,* both locally and generally, than to merely *leave* it upon completion to speak for itself, to those who will hurriedly pass over or under it, without considering it, or realizing it to be an engineering and architectural development deserving of prominence. And it is with this idea in view—now that the actual work is *done* —that we are glad to do our part in partially analyzing its constructive features.

The work is done, it has been accepted and paid for, hence there are no axes to grind; and, consequently, we take this to be an excellent opportunity to express some of our experiences throughout the construction, and our observations on the *results,* in a manner that will do some good to other Contractors and Engineers.

To do this, we must be *definite,* and more or less *frank.* Therefore, some of our statements may seem somewhat complimentary to either the City Bridge Department or ourselves, and, on the other hand, some may seem critical—all, however, meant only to help bring Engineers and Contractors further into each other's confidence, producing ultimately—through the organizations of each—much good toward the perfection of practical designs and fair specifications, the production of honest work with proper facilities, resulting in *unusual quality.*

Conseequently, it is *not* the purpose of this paper to enter into technical or architectural discussion, but to treat of the equipment and methods employed to facilitate the operation, and to accomplish the work within the contract period; also to make some observations on the results.

The Kingshighway Viaduct is 1857 feet long and 90 feet wide, and consists of a series of arches constructed entirely of reinforced concrete, with retaining walls at each end. Its central arch has a span of 170 feet, over five tracks of the Frisco System; north of this is the second main arch, spanning 140 feet, over four tracks of the Missouri Pacific System; south of the central is the third main arch, which also spans 140 feet. The rise of each is one-tenth of the span. (See Figure 1.) These three main arches, with their four piers, constitute a single elastic system, independent of the remainder of the structure, and as a *group* are supposed to be the largest in the world.

Flanking the three main arches on the north and south, are series of six smaller arches, in groups of two, each spanning 25 feet—and beyond these the retaining walls extending about 275 feet, to the North and South monumental entrances. (Figure 2.)

The whole structure is surmounted by a concrete balustrade, with a monolithic hand-rail. The balustrade was cast in units on the ground. (Figure 3.) Through the use of accurate forms and careful placing (with a small derrick) the resulting appearance of the finished balustrade (Figure 4) is exceptionally good, since the joints are barely noticeable and the quality better than had it been placed monolithically.

On account of the size and width of the arches, the piers and abutments are quite large, and would have been uneconomical in solid plain concrete. They are all hollow, with vertical diaphragm walls in each direction, and horizontal diaphragms at the spring lines of the arches, the spaces below being filled with puddled clay.

This clay was placed by three methods: one a drag-line scraper used where the necessary earth was near by; another, a derrick rigged to pick up and dump wagon beds used where the earth had to be hauled; and the third, a clamshell bucket on a locomotive crane used where it was practicable for the crane to work.

Weather conditions were favorable throughout the work, causing only the average delay and expense, except that on September 3d, 1910, a terrific rainfall put about seven feet of water in one of the main pier excavations, causing unlooked for pumping, caving and shoring—the viaduct being wholly on "dry land."

Except in a few emergencies, all materials of construction were delivered on cars on private side tracks from both the Frisco and Missouri Pacific main lines. The central plant for the whole work, *operated entirely by electricity,* was located between these tracks, and nearly in the center of the viaduct.

In side elevation or longitudinal section, this central plant covered about 500 ft., and allowed at least 2 cars of cement, 6 cars of sand and 12 cars of gravel to be on hand and within *reach,* at any time.

A continuous canvas belt conveyor, running in a tunnel under the elevated unloading track, and thence up to the bins above the mixer, as shown in Figure 5, carried both sand and gravel, and served the whole of the work most successfully. Frontispiece, taken from the top of the bins and looking down the belt to the tunnel and trestle, is shown for the purpose of briefly describing the unloading of the sand, gravel and stone (about 35,000 cubic yards in all), the *average* labor on which was 9c. per cubic yard, which we believe is comparatively low, and of general interest —to Contractors, at least.

The plant serving this unloading, cost something, of course, but was estimated *separately* and *carefully,* just as the amount of cement or excavation was, for instance, and, therefore, caused no unpleas-

KINGSHIGHWAY VIADUCT IN COURSE OF CONSTRUCTION

*Read before the St. Louis Branch of the Am. Soc. Eng. Contr.

FIG. 1

ant surprise in its cost, when installed. Side and bottom dump cars were unloaded from the trestle, whenever possible, and ordinary gondolas were unloaded by the locomotive crane, seen on the trestle. Sand, stone and gravel were stored separately under the trestle, and were fed separately through bin gates onto the belt running in the tunnel beneath. The man on top at the bins signalled the belt feeder in the tunnel when to begin or stop loading stone, gravel or sand. This was done by flickering the lights in the tunnel so many times for each need, by means of a knife switch in the circuit, at the bins.

The great advantage of this layout was that materials could be stored ahead ready for immediate use, giving protection against poor delivery or bad weather. The bins above the mixer held only about 20 batches, enough to supply gravel while sand was coming up on the belt, or vice versa. From storage bins sand and gravel moved by gravity to measuring hoppers directly over the mixer, and in these hoppers, cement, sand and gravel were proportioned for proper concrete mixture.

Eight different mixtures were specified and used for the different classes of work, the specifications stating that a definite number of cubic feet of concrete in place must be made from each sack of cement. Mixtures ranged from 2.2 cubic feet per sack for facing mortar to 4.5 cubic feet for arch rings and 8 cubic feet for footings.

Right here we wish to discuss this point. Our experience is that it is very difficult with common labor, which must of necessity be employed for this class of work, to produce an accurate concrete mixture, except by determining beforehand the amount of each material to be used. It is practically impossible to get a definite volume of concrete from any specified mix without knowing the percentages of voids, and as these vary from time to time in all materials obtainable commercially, we believe from the constructor's standpoint, at least, definite quantities of each material should be specified for the different mixtures. If it is thought advisable to further insure the use of a proper amount of cement, specifications should state that a definite amount is contemplated per cubic foot of each mixture, and that if less is actually used, the saving will be credited to the owners' account. We cannot see that anything is to be gained by specifying that a certain quantity of *concrete* is to be obtained from a fixed amount of cement since the concrete must be *placed* before exact quantities of materials used are known.

The batch mixer had a capacity of ½ cubic yard of mixed concrete, and the hopper cars used to distribute it, from the tramways, had the *same* capacity. Both of the tramways, the upper and lower (see Figure 7), did not exist in complete form at any one time—the lower being removed as fast as it accomplished its purpose, and its timber and track materials used to extend the upper, which latter was built solely for concreting the main arches and their floor systems above.

The largest amount of concrete placed in any one day was 435 cubic yards in 14 hours, and the *average* amount, counting the 190 days on which the concreting plant was run for 5 hours, or over, was 135 cubic yards per day. As there were only a very few days throughout the whole of the work during which a large mixer and faster plant could have been of any benefit, this contract, with 26,000 cubic yards of concrete placed, proves rather conclusively that the larger mixers and so-called "fast plants," with their increased first cost, are not needed on this type of structure. However, they might be economical on other work having no greater yardage than this, but allowing of greater daily deposits, as would be the case with bulky foundations or heavy walls.

Returning now to description of the work proper—a discussion of the character of the foundation and the concrete piles in the same will be of interest. The soil through the valley, the depression spanned by the viaduct being known as Mill Creek Valley, was very unfavorable for proper foundations, being composed of a mixture of plastic clays, unstratified, with no underlying rock within reasonable depth. In the first or South main pier the ground proved to be the least homogeneous, being difficult digging with treacherous banks.

After the excavations had reached the required depth for the main piers, concrete piles were sunk to a depth of 11 feet to 13 feet, which was as far as it was possible to drive them (the plans asked for 20 feet). When the specified number had been placed, load tests on individual piles and on groups were made by the engineers, the result being that the number of piles was ordered increased from forty to sixty per cent. in the different fields, because of their low sustaining power. When extra piles had been driven, further tests showed that while those under load sank, others rose.

Concrete piles for three main piers had been driven during this time, but after careful study, were omitted in the fourth. It was then decided to skirt each field of piles with an enclosing reinforced concrete wall with three cross walls forming a sort of box, to a depth of one foot below that of the piles. Upon these walls—and the exposed piles—the footing slabs were placed, in alternately constructed monolithic sections running longitudinally. This change absolutely solved the settlement problem in these foundations, and saved the City several thousand dollars, by reason of the reduced lengths and numbers of the concrete piles.

A number of methods were tried for distributing concrete, but the one finally adopted and used for the greater part of the work consisted of industrial tracks on light movable trestles with one-half cubic yard cars having fixed hoppers and undercut radial gates. For this particular work the car and track system of distribution proved very satisfactory as to economy, flexibility and capacity. (See Figure 8.)

FIG. 2

FIG. 3

For the arch centering of the main arches, piles were driven and capped about 18 feet above the ground and the timber work erected from that elevation, except in spanning the Frisco tracks, where 34 foot steel I beams on timber bents were used. (Figure 9.)

The specifications called for an expansion joint longitudinally through the center of three main arches, and the centering designed by the contractors was such as to serve the East half of each arch first, and when concrete of this half was sufficiently set, wedges were struck and the entire centering dropped on rollers and pulled across to West half of arches.

Figure 10 shows plainly the centering of the South 140-foot arch after being moved to new position, but before it was jacked up into place. The time required for moving each center was one-half day, with two and one-half days for elevating and wedging into position, the labor force consisting of one foreman and twelve men.

The timber bents spoken of at the Frisco tracks, were placed on reinforced concrete footings, with the wedge line at the *bottom* of the bents, the entire bents being moved with the centering. The *saving* in this method of handling centering consists in the elimination of the labor of wrecking and again erecting in new position, with consequent large saving in time.

An unusual condition and its results, which happened in November of 1911, will be of interest to every one engaged in the design and building of reinforced arches. Figure No. 11 will assist us to more clearly explain our observations and conclusions. A sudden drop in temperature of about 50 degrees from Saturday evening to Monday morning caused the contraction and lowering of the arch ring, which had already been in place three or four weeks and probably had from sixty to seventy-five per cent. of its ultimate set. The centering of the same sills, wedges, etc., that had been used for the first and then moved to the second half of the arch, without any actual failures of the timbers, was so heavily overloaded by the contracted arch ring, that the bottom wedge plate was badly crushed and broken. This occurred in the central 170-foot arch.

In the north 140-foot arch, where all of the centering was on pile bents with no wood bents, the results of the contraction showed up in a different way. These pile bents being practically unyielding vertically, deflected sidewise in two of the central bents, where the spans over the tracks were much longer than the others—the I-beam bearings being reduced from seven or eight inches to as low as two inches.

An actual failure would have dropped the centering material onto the Missouri Pacific main tracks. Therefore, we wish to express some personal views regarding certain unreliable specifications, relative to arches, carried forward in part from the days of the masonry arch, and in part for the reason that there are no modern treatises on the subject to which Engineers can refer for information. Consequently it seems to us that the constructors who are properly designing and watching, and who are responsible for such work, are the ones who are gaining the most practical points on the action of reinforced concrete structures and on the details of such things as the centering and forms for heavy work.

In contrast to what we have just described as caused by arch ring contraction, we have noted on other contracts that *expansion* of the arch ring has actually taken it *off* of the centering, giving the appearance that the centering had settled after it had carried successfully the load of the arch ring, while wet and without strength.

These observations show that no stated time should ever be named during which to leave the centering in place, unless it is absolutely known, which is rarely ever the case, what the approximate temperatures will be during the construction. Using an unyielding centering, if there be a sudden cold spell, even a reinforced concrete arch ring might break, in which case a specification which did not foresee damage due to temperature changes might make both the Contractor and the Engineer liable, in each other's minds, and the real cause of the failure might *never* be known.

It has been our experience on almost every contract that the specifications put it up to the Contractor to properly design and be responsible for the stability of the centering, with the further statement that the same shall remain in place 20, 30 and 40 days after the completion of the ring. We do not mean to intimate that the centering should be designed in detail by the Engineer, as we believe it to be a part of the Contractor's work to supply this feature of any contract, but we *do* believe that more attention should be given toward providing proper soundings over the field of the centering. Proper notes as to what obstructions to an ideal plan there are, such as open channels, railroad tracks, etc., should be provided; and, lastly, definite information as to how the arch ring is to be poured, for experience has shown us that several eminent Engineers have widely different opinions on this point, nearly all of which affect the centering in a different way. We wish that we might continue this subject even further, going into the question of proper allowance for settlements, proper design against movement at the haunches, etc., but this is hardly the occasion for it, as we are supposed to be considering only one particular contract.

FIG. 4

In providing the centering for the small arches, it was decided to make them partly of steel and partly of wood, in order to get a comparison in cost between the two types. The steel centers were of a design submitted by the manufacturer, hinged at the center, with tie rod to prevent spreading, and having a clear span, supported at the piers by bents. (Figure 12.) Wooden centers were of our own design and were made on the ground by ordinary bridge carpenters; the design being such as to allow them to be easily taken down and reused.

For this particular work, the first cost of the wooden centers was one-quarter the cost of steel. The labor cost of erecting and handling the wood was highly satisfactory, while that of the steel was a disappointment, principally because we were not able to reuse them as often as originally figured. It must be said, however, that the progress schedule was changed so as to demand more centering.

In this connection it should be borne in mind that this centering was for dry land work and the clear span provided by the steel construction was of no special value; also that the reduced number of times centers could be used favored the wood. Where a set of centers can be used many times, or where it is necessary or economical to have a clear span between end supports, metal centers may be justified, but *not* in locations and for spans similar to those in the work being described.

FIG. 5

Speaking now of the *permanent* part of the arch work, the barrels or rings contain the usual upper and lower systems of reinforcing, starting well down in the horizontal diaphragms of the piers. They were concreted in transverse segments or voussoirs, which were required to stand 10 days before removal of bulkheads (Figure 13). The bulkheads were made by setting 3 x 3 uprights between the reinforcing bars and fastening heavy canvas to them, between and below the upper and lower systems of reinforcing

The construction of the large arch rings in voussoirs was specified, the idea being to provide convenient stopping places in concreting and further to allow the centering to take its full deflection before the voussoirs were finally keyed in and the arch completed. The bulkheads described, which were very satisfactory, were designed by Engineer Janni.

Finally, a few remarks on total costs—

Estimated cost by the City.....	$400,000.00
Actual cost in payments made to the Wm. P. Carmichael Co., about	387,000.00
Total cubic yards of concrete..	26,010.00
Average cost per cubic yard of concrete, absorbing all incidental work, such as drainage system and excavation, about	15.00
Tons of reinforcing steel used..	1,500.00

Only rental and depreciation of *plant* were charged to this work, in accordance with our standard rules for all major equipment regardless of what work it is first purchased for, and the plant cost thus figured was 17c. per cubic yard. This does not include ordinary tools and general supplies, the cost of which was about 19c. per cubic yard. The fuel cost for both electricity and coal (the latter used on pile-driver and heavy derrick) was 11c. per cubic yard. Plant maintenance, an item usually underestimated or even omitted, was an even 16c. per cubic yard of the total concrete. This cost covered revisions in plant, repairs, and general maintenance of all labor equipment, and is mostly labor, which too often has been classified as "miscellaneous," and which for future reference in estimating means *nothing*. Therefore, the total cost of the foregoing items was 63c. per cubic yard.

The contract provided that the work should be completed within twenty months and it was originally planned to consume about that much time. However, it was later decided that, because the work was distributed over such a large area, it would be possible to increase the force, and at about the same cost, complete the work in less time. With this end in view, a carefully planned progress schedule was made out,

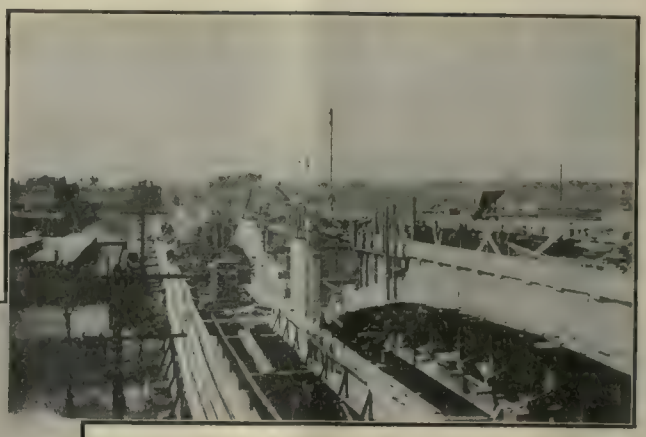

FIG. 7

FIG. 8

the work being timed for completion in December. It is very gratifying to be able to state that this schedule was adhered to, and that the original contract, together with approximately $50,000.00 worth of additional work, was completed several months prior to the specified limit.

Finally, it is highly appropriate that we should accord to the various City Officials the credit which we feel is due. The Designing and Supervising Engineer has planned and carefully supervised for the citizens of St. Louis a modern, permanent structure; the City Officials from the President of the Board of Public Improvements through and including the engineers, have handled this proposition, involving some $48,000, in an eminently fair and business-like manner. The result is a triumph in bridge architecture (Figures 14 and 15), combining, with plainness and stability, a slightness of arch, with sufficient exterior embellishment to make it a permanent satisfaction to the community and to those who will daily pass over and under it.

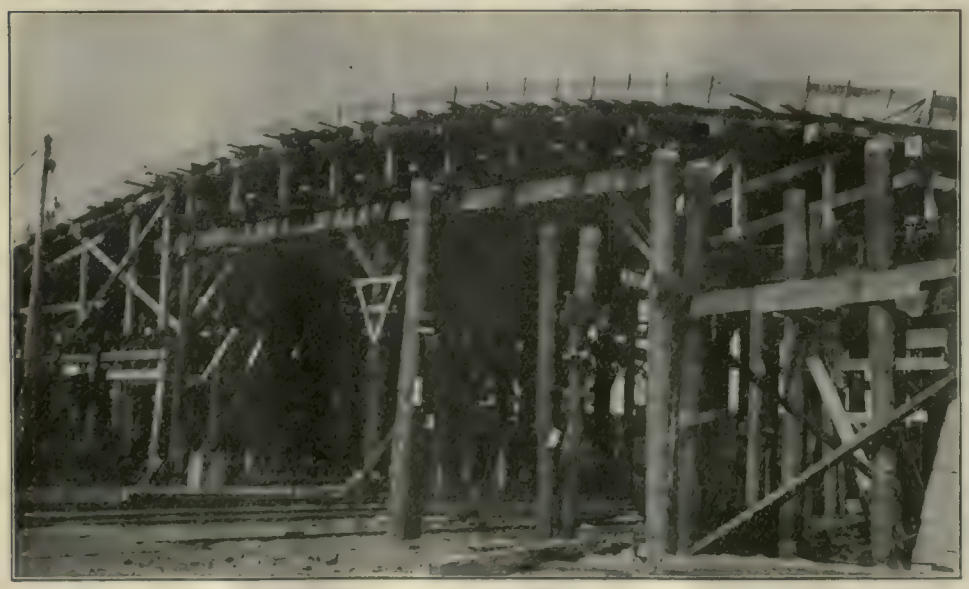

FIG. 9

DISCUSSION

Messrs. Andrews and Cryder referred to the difficulty of selecting various grades of concrete. In regard to this point, Mr. Schuyler, Engineer-in-charge of the Testing Laboratory of the City of St. Louis, who had assisted in the preparation of the specification, said:

"The aggregates, both fine and coarse, were required to satisfy a certain mechanical analysis. Experiments carried out in the City's Testing Laboratory proved conclusively that, within the limits specified for the grading of coarse and fine aggregates, the voids were practically constant; i. e., well within two parts of forty. The difficulty mentioned by Mr. Andrews in estimating the correct amount of cement to be used per batch of concrete lay primarily in the fact that the grading specifications were not enforced as was expected.

"Secondarily, the difficulty was due to the fact that no allowance was made for the moisture content of the sand as received. It is common knowledge that moisture contained in sand measured loose renders the weight per cubic foot less than that of an equal volume of dry sand. In the case of the sand used on this job the weight of one cubic foot of dry was 107 lbs., but it was only 86 lbs. per cubic foot when 3¾% of moisture was present."

In Mr. Schuyler's opinion, "a reading of the specifications for concrete on this structure will convince one that the amount of sand used should have been determined from its dry condition, and had the aggregates been graded and the effect of sand moisture allowed for, no difficulty would have been experienced in determining the amounts of the several concrete ingredients that should be used in order that every 4½ cubic feet of concrete in place should contain 1 sack of cement when the usual 1:2:4 mixture was desired."

In responding to Mr. Schuyler's remarks, Mr. Andrews stated that he and Mr. Cryder had mentioned the point, in order to call forth discussion of the same. Their contention did not bear on the relative strength of concrete when made of correctly graded aggregates or otherwise, but "that specifications should allow for the use of materials obtainable commercially and not call for laboratory exactions and conditions on a construction job." Mr. Andrews further

stated that "when prices were asked on aggregates to conform to the specified grading, some producers refused to quote, saying they could not furnish the material, while others wanted from three to six times the regular commercial price."

The speaker further stated that, "as to the moisture content of the sand, the impracticability of making allowance is evident. The amount of moisture in sand varies from day to day because of changing weather conditions, as well as from its location in the storage pile, being greater on the interior than on the exterior, where it is exposed to sun and air.

"Furthermore, in actual construction the contractor must of necessity use ordinary labor for work of this nature and the average laborer is hardly qualified to conform to laboratory exactions."

In commenting further upon the specifications governing the construction of the Kingshighway Viaduct, Mr. O. W. Childs, former City Bridge Engineer, made some interesting remarks, as follows:

"In the construction of concrete work, under the usual form of specification, which provides that concrete shall be mixed

FIG. 10

in certain stated proportions of cement, sand and broken stone or gravel, there is frequently a tendency to save cement. This is a source of friction between the contractor and the engineer.

"Previous to the building of the Kingshighway Viaduct, it had been customary for the city bridge division to furnish the cement for contract work, and under this method the engineer-in-charge could control the amount of cement put into the concrete without any tendency to friction with the contractor.

"When preparing the specifications for the Kingshighway Viaduct, it was thought best to include all material in the one contract. It was considered desirable to specify the amount of cement to be used, in such a manner that it could be easily checked up and that the contractor could figure definitely on the amount he would be required to use.

"In order to do this the specifications were drawn without giving the proportions of the mixture, but they stated that one sack of cement should be used in a certain number of cubic feet of finished concrete. This amount varied in various classes of concrete, one sack of cement being specified per four and a half cubic feet of concrete in the more important portions to eight cubic feet of concrete where concrete required little strength and was practically used as heavy filling.

"This method of specifying the amount of cement, while not an ideal method, seems to have worked out very satisfactorily in use, and while it had been tried to a limited extent heretofore, I do not know of its having been used on work of any magnitude previous to this.

"Regarding the specifications for the centering of the three main arches, the specifications provided that the arches could be constructed one-half at a time by dividing the arches longitudinally along the center line. These three arches are all in one system and will not stand singly, therefore, all had to be provided with centering at once. It was provided that they might be constructed in longitudinal halves, in order to permit the contractor to erect centering for one-half and, after this half had set sufficiently, to move the centering bodily over to the other side and use it there. This worked out very satisfactorily for two arches, but because the railroad tracks under the third span were at an angle, the centering had to be different for the two longitudinal halves of this arch. Also the arches were split longitudinally to reduce the size of the sections of concrete to be put in without stopping work.

"The arches were concreted in sections, not continuously, and the sections were each placed in one continuous run. Spaces of about two feet were left between adjoining sections and these spaces were concreted after the main sections had thoroughly set. This method of construction worked out very satisfactorily and is, I believe, the only satisfactory way to get good results in arches of any considerable span."

One or two members present expressed doubt that there could be much more improvement in the application of concrete as a true building material, i.e., for outside finish and ornamentation. In the opinion of Mr. H. M. Cryder, Vice-President William P. Carmichael Company, of St. Louis, this point of view is wrong, and "we are only beginning to learn how and when to use concrete and what are its possibilities, as a substitute for brick, stone and terra-cotta." He referred to some work which his firm had done in Mexico, in which case they were unhampered by out-of-date specifications, labor complications, and the general fear that concrete could not be made to have an acceptable appearance. By the use of forms, plastered with plaster of paris on cheap expanded metal or chicken wire, and a little more than ordinary care in gaining absolutely level courses, brought to a predetermined line on the forms, which lines fall where they will be least visible, after removal of forms, they were able to gain an exceptionally good exterior wall and embellishments in monolithic concrete, having only to rub down the exterior surface with a native lava stone, called "tsontli," and water, in order to produce an even color.

Mr. Cryder said further: "We have completed two large buildings which occupy prominent corners in Mexico City, with exteriors wholly of reinforced concrete, and have learned so much ourselves about the handling of structures, which are larger than the ordinary house, that we do not hesitate to confirm the remark made at the outset, i.e., that we are only beginning to learn how to handle and use concrete, and that its use as a first-class building material does not have to be limited and soon will not have to be limited to smaller structures."

With reference to the treatment of concrete surfaces, Mr. John E. Conzelman, chief engineer Unit Construction Company, of St. Louis, gave some very interesting facts, as follows:

"In the treatment of walls or vertical surfaces, there are various methods of finishing concrete which may be classified under the following subjects or methods:

"The first and usual method is to cast concrete against wooden forms, working the concrete back so that the mortar will come to the surface. This process usually results in a bad looking job, even though the surface of the concrete is good. This is due to the fact that, in general, no attention whatever is paid to the arrangement or design of the forms. If the forms are so built that they themselves have an attractive appearance, the resulting surface will not be of the usual monotonous kind, and an effective paneling can be obtained on a flat surface. This method involves using both horizontal and vertical boards or sheeting, or even boards placed diagonally, the boards being arranged to give the effect of a paneled wooden partition. It is subject to a large variety of treatments, and gives excellent results. It would appear to be the logical way of treating a surface for inexpensive buildings.

"The second method consists in casting against special forms of a porous nature, such as plaster forms, referred to by the previous speaker.

"The third method is a treatment, or finishing, of the surface while the concrete is still soft. This method is practicable mainly when the slab is cast flat leaving the top surface exposed. It is evident that it could be applied to the construction of walls or vertical surfaces only when the slabs, etc., are cast as units, and set after the concrete has hardened. This method

FIG. 11

FIG. 12

gives opportunity for a great variety of finishes. For instance, the surfaces may be trowelled to a smooth finish or floated to a sand finish, or the general surface may be slightly roughened by means of burlap or similar material, and a smooth band may be worked around the edges in patterns. Insertions of tile or similar material may be included under this method, and, in fact, an almost endless number of different treatments is possible.

"The fourth method covers the finishing of the surface after the concrete has hardened. Brushing green concrete in order to expose the aggregates comes under this head, although it might be said that brushing has not proved satisfactory for the reason that the work must be done just when the concrete has set to the proper degree.

"The other methods in general use are bush-hammering, rubbing with abrasive bricks and sand blasting. Bush-hammering brings out the texture of the concrete better than the other methods, but in order to produce a pleasing effect by any of these methods it is necessary to have the concrete properly proportioned, and made with proper aggregates. The object of this treatment is to cut away the coating of mortar which covers the coarser aggregates, and if gravel is used it should be selected of uniform color and should be rather small in size. This is not so important when crushed rock is used, for bush-hammering cuts down the rock much more easily than it does gravel. Sand blasting gives much the same appearance as bush-hammering, but the effect is not so uniform or pleasing. This is due to the fact that sand blasting merely erodes the exterior coating but does not even up the surface. Sand blasting also wears away the concrete rapidly, and in reinforced concrete it is necessary to use this process with care, otherwise the bars may be exposed. The rubbing method is in common use and gives a smoother and whiter appearance than bush-hammering or sand blasting.

"Treatment by acid is another method which has been used, but is difficult to apply to vertical walls. A weak solution of muriatic acid will attack concrete and expose the aggregates, but the process is very slow unless it is accelerated by rubbing. Painting, although not strictly a surface treatment, yet might be mentioned as one of the methods of improving the surface of concrete.

"Generalizing from the foregoing it would seem that the proper time to put the finish on concrete is when the concrete is poured, either by means of forms to produce the finished surface or by working the finished surface by hand. After the concrete has set, bush-hammering seems to be the logical treatment, and, since its cost will generally be about the same as that of sand blasting, which require expensive apparatus, it is probably more desirable.

"One feature that seriously affects the appearance of finished concrete is the nature of the sand used. Very fine sand will not give dense, solid looking concrete. This feature is especially true of the Merrimac River sand used locally, which contains a large percentage of extremely fine particles. When wet these fine particles form a gluey quicksand which prevents the cement from entering between the particles; this results in concrete having sandy spots in spite of rich mixes and correct placing."

In concluding the discussion, Mr. A. C. Janni, who is the designer of the Kingshighway Viaduct and who acted as Supervising Engineer during the construction, said: "While the Specifications for the Kingshighway Viaduct were written by me, the part of them which deals with the concrete materials, their grading and measurements, were written by Mr. Mont. Schuyler, Engineer-in-charge of the Testing Laboratory of the City of St. Louis. Although he has already discussed the matter before you, I think that I can add a few words on the practical side of the question.

"I must say that the system adopted worked pretty well in its application to this construction, especially because it avoided troublesome discussions with the Contractors.

"In the evening of a concreting day, I received a report from the Inspector in charge of the mixing plant, on the number of sacks of cement used during the day; and I received also, from other Inspectors, the approximate volume of form space concreted in that day. Putting together the amounts, I found very slight differences between the actual amount of cement used and the theoretical one; very seldom did they differ.

"To get this result, however, it is necessary to have, as we had, a very competent Inspector at the mixer, and to exact also from the Contractor that he keep always the same men at the mixer.

"It is true, as Mr. Andrews says, that in actual construction, the Contractor must, of necessity, use ordinary labor, but there are a few places in concrete work where the ordinary average labor is not good enough. The man at the mixer is unjustly underrated, while, actually, upon his discernment depends a good deal of the success of the job.

"The subfoundations, proposed by me after the unsatisfactory results of the pile tests and adopted by the City for the four main piers of this Viaduct, show once more how resourceful and successful reinforced concrete is for foundations or subfoundations upon unreliable soil.

"I think that it is worth considering further what happened during a night of November, 1911, which Mr. Andrews has referred to.

"The Designer of a reinforced concrete arch must consider all possible normal conditions, like what happened that night. The Contractor's duty is only to follow the plans and specifications in building his arch; he cannot look after the design also; otherwise what would be the Designer's task?

"It is noticeable that the 170-foot arch of this Viaduct, at the spring, has an additional reinforcement at the intrados side. Such reinforcement is obviously put there, not as a compression steel, because had

FIG. 13

there been too much compression it could have been relieved by adding the proper amount of tension steel on the extrados side; but it was put there just to prevent the cracking of the barrel at that point, should any important contraction take place in the concrete during the time the barrel was still on its centering.

"This additional reinforcement at that point of the 170-foot arch is very noticeable, while it is not for the two 140-foot arches; this is due to the fact that the intrados reinforcement at the springs of the 140-foot arches was not necessary as compression steel; so that the intrados reinforcement at those points for the 140-foot spans was merely a tension steel, which eventually would work, as it did, during the construction of the arches of this structure.

FIG. 14

"Nobody could say, with any degree of accuracy, what would have been the loss to the City in dollars and cents that night, should the arches, under such tremendous tension, have cracked; but everybody can see that the small amount of money spent by the City for that additional reinforcement was not wasted.

"Should the arches have cracked the Contractor could not have been, in that instance, called responsible at all.

"In closing I desire to express my appreciation of the manner in which the contract was handled by the Wm. P. Carmichael Co., and to express the pleasure it has been to me, personally, to have been associated with them on this work."

FIG 15

ENGINEERING LAW

Among the good things included between the covers of this paper, you will find this new section the very thing you need.

The principal aim of this department is to familiarize the contractor and the engineer with engineering law. This is no small job, for it involves much labor and expert advice. It is necessary to have the judgment and opinions of men who have a thorough knowledge of law, combined with an engineering and contracting experience that will qualify them to see the question from the standpoint of the contractor or the engineer.

A question box will be provided for those who desire enlightenment on particular phases or legal points governing specifications and contracts, the letting and execution of same, and the different interpretations of the various wordings. The one question and answer appended to this introduction will give you a better and clearer idea of just what form of questions will be published for specific and general information.

Many have suffered losses and annoying delays that might have been avoided through a better comprehension of the legal points involved. It is the object of this society to supply you with information in regard to these matters. Furthermore, it is our ambition to effect a change for the better, through this department, which we hope and feel will become a great benefit and assistance to our members.

In writing questions address Law Department.

QUESTION. We are material men incorporated in the State of Connecticut, and are just about completing a small contract which we took in the City of New York which requires us to use our materials and to furnish the labor to construct and place it.

In a heated conference the other day the city people told us we would never get a cent of our $2,500 contract price unless we did what they wanted, as we had failed to secure the proper certificate to do business in the State of New York, and hence, could not sue them if they refused to pay. Will you not kindly advise if they can carry out their threat?

ANSWER. Your question is not of sufficient detail to permit our giving an absolute answer. It is a fact that if you are doing business in this State without having complied with the various State statutes respecting the securing of a certificate to do business, and respecting the payment of certain taxes and fees, you cannot sue the party with whom you have the contract in the State courts. If your claim against them had amounted to over $3,000 so as to give the Federal court jurisdiction you could probably recover your compensation, although there is still some conflict of authority on that question. Of course this disqualification which prevents an action in New York State does not extend beyond that State and if you can get proper jurisdiction of the New York party in any other state you could sue them there. It is recommended that for the future you either comply with the New York statutes or be sure and have your contracts made in the State of Connecticut.

Candidates for Office

At a regular meeting of the Board of Directors, held in the Rooms of the Society, in New York City, on November 26th, the candidates formally named to the offices to become vacant at the Annual Meeting, were as follows:—

PRESIDENT

EDWARD WEGMANN, New York City, N. Y.
Consulting Engineer, Dept. W. S., G. & E.

JAMES L. WESTLAKE, St. Louis, Mo.
President, Westlake Construction Company.

FIRST VICE-PRESIDENT

JOHN F. COGAN, New York City, N. Y.
President, John F. Cogan Co., Contractors.

H. F. HACKEDORN, Indianapolis, Ind.
President, The Hackedorn Contracting Co.

SECOND VICE-PRESIDENT

J. H. TROMANHAUSER, Toronto, Ont., Canada.
Engineer, Contractor and Builder.

RAOUL de B. CORRIVEAU, Ottawa, Canada.
District Engineer, Dept. Public Works

DIRECTORS

FREDERICK A. SNYDER, New York City, N.Y.
Engineer, The Tunnel Company.

H. F. POMEROY, New York City, N. Y.
Business Manager, Engineering News.

HOWARD EGLESTON, New Orleans, La.
Chief Engineer & Gen. Mgr. Petrolithic Good Road Develop. Co.

WILLIAM L. BOWMAN, New York, N. Y.
Civil Engineer and Attorney-at-Law.

T. W. CLARK, Boston, Mass.
Vice-Pres. & Engineer New England Foundation Co.

T. H. LETSON, New York City, N. Y.
N. Y. Sales Mgr., American Hoist & Derrick Co.

Heretofore it has been the practice to nominate candidates from separate sections of the Country, thereby giving the same representation on the Board. Only the bare number of Directors required for a quorum were selected from New York City and vicinity. Unfortunately, it happened many times that some of the New York Directors changed their location, and could no longer attend meetings. This frequently made it impossible to get a quorum at monthly meetings, and therefore it was deemed advisable to nominate a greater proportion of New York members that had been the practice formerly.

Proposed Amendments to the Constitution

The Board of Directors discussed several amendments to the Constitution of the Society. After careful consideration had been given to the matter the following was adopted for submission to final vote of the members of the Society:

Article VIII., Section 1, is to be changed so as to eliminate the requirement for two lists of candidates. This amended clause would then read :—

> "At least 60 days before each Annual Meeting the Board of Directors, which shall sit as a Nominating Committee, shall nominate to the Society one (1) list of Officers for the next ensuing year, and one (1) list of three Directors to serve for three years."

This is in accord with the practice of the leading Technical Societies. At present we are nominating two good men for each of the offices, knowing that one of them is bound for defeat and relegation to the ranks if he remains active in the Society. Thereby we run a chance of losing the active co-operation of one good member through the double nomination for each office. This amendment would be of benefit to the Society at large.

At the same time, the membership is protected against discrimination or partisanship through the privilege extended to twenty members of the Society to petition for, and submit a separate list of candidates to be voted on by the members.

Committee Work

Valuable and important reports will be presented at the Annual Meeting by a number of the Committees of the Society. This feature will be emphasized much more in the future than it has been heretofore. It is realized that the work of the Standardizing Committees is probably the most vital to be done by the Society in improving conditions governing contract work. These reports will be published complete in subsequent issues of The Engineering Contractor.

Annual Meeting

The Annual Meeting of this Society will be held on the third Friday in January, which falls on the 16th day of that month, and it will be a memorable day, so don't forget it. It will be noted that this date is immediately following the Annual Meeting of the American Society of Civil Engineers and then, therefore, many out-of-town members who come to attend that function will be able to attend our Annual Meeting without appreciable inconvenience or additional expense.

Just mark the date with a red cross on your calendar, and leave that day open that you may attend. The Meeting will be called to order in the United Engineering Building, 29 West 39th Street, New York City, N. Y.

Although the program has not been definitely settled we can state that at the Evening Session, Mr. George C. Warren, President Warren Brothers Company, Boston, Mass., will show moving pictures on road construction in Boston, Troy and Binghamton, and as the pictures are thrown on the screen, Mr. Warren will give an interesting explanatory talk. There are arrangements being made with other members for the program, but nothing definite can be said until the end of the month.

Remember the Date and be There—January 16th, 1914

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY
OF ENGINEERING CONTRACTORS, INC.

AM. SOC. ENGINEERING CONTRACTORS 1909

Volume I —No. 3
NEW SERIES
DECEMBER, 1913

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Published Monthly by the *American Society of Engineering Contractors, Inc.*, 11 Broadway, New York City, N. Y.

Copyrighted 1912, by the American Society of Engineering Contractors, Inc.
Entered as Second-Class Matter April 16, 1912, at the Post Office at New York, N. Y., Under Act of March, 3, 1879

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At a meeting of the Board of Direction of the American Society of Engineering Contractors, Inc., it was voted, that *The Engineering Contractor*, shall be the official means of communication with members of the Society and that all notices heretofore sent out in circular form will be inserted therein, and shall be considered as legal notification, except in case of emergencies.

THE January issue will contain a full account of the Annual Meeting of this Society, held in the United Engineering Building, New York City, on January 16th.

The reports of the Secretary, the Treasurer and some of the Committee reports will be published in the same issue.

THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume 1 NEW YORK, DECEMBER, 1913 Number 3

Legal Regulation of Specifications

YOU CANNOT LEGISLATE HONESTY IN PUBLIC OFFICIALS is the favorite comment of those who do not think it wise to try to regulate and control conditions governing the award and execution of public works by legal enactment. We certainly agree with that sentiment, but does legislation make the burglar virtuous? What's the use of any law? True, it don't amount to anything if not enforced, but if it does not exist, it cannot be enforced.

Anyhow, it was for the purpose of inviting discussion on this point that this Society published in May, 1913, a proposed law called "An act to regulate State, Municipal and other Public Contracts for Construction and for the Purchase of Supplies."

In a paper which is published in this issue, Mr. Thos. H. Ray, who is a specialist in contract law, criticises our proposed act, using the New York City Charter as a criterion.

The New York City Charter.

In the first place, we do not think that the New York City Charter is the proper guide in this case. The fact is that the proposed law was aimed not against big cities in which these things are well provided for, but it was designed to apply as well to the small town, the village, the borough, which is very imperfectly and insufficiently supplied with legal guidance in the matter of public contracts operation and treatment.

What good does it do the village of Specif, which employs an expert engineer at fifteen per, to design everything from the gasoline engine used to operate the water works to the newly elected mayor's proposed garage, if the city of Ication, where they have lots of money and are well and amply supplied with experienced men, some of which are real specialists, who can protect the latter city from the dark schemes of the wicked contractors. That's the question.

In the aggregate a huge amount of work is done by the small places who have to depend on the first mentioned class of engineering service, and it is the method of conducting that class of work that has proved especially objectionable and costly to contractors. We have met many, many contractors all over the country and have seen and heard both sides of the question, and we have concluded long ago that they get it "rubbed in" a little more than the average inoffensive individual. In fact we claim that the engineer who really knows his business is the one who has first been a contractor or worked for one.

Therefore, we think that little good will result from arguing that because the New York City Charter is a fine thing for the contractor, no new law is necessary.

A Unified Code of Procedure Essential.

What was aimed at was not to add to the top heavy stock of fifty-seven varieties yielded by our legislatures, but, rather, to provide a compact and unified code of procedure.

As Mr. Ray states, all the provisions governing public contracts are interspersed among the various city charters, the General Municipal Law, the Second Class Cities Law, The Town Law, The Village Law, and the corresponding statutes in other states.

Now, frankly, is that a logical and businesslike guide for the official or engineer who is such an important factor in public work. We believe and know that many an engineer would welcome a legal criterion by which he could reinforce himself in his polemics with the village council composed of the blacksmith, the grocer, and the undertaker and which, therefore, esteems itself competent to decide important technical questions.

There is no reason why the good points now in the New York City or Chicago or any city charter should not be incorporated in our proposed law and there is no necessity of tearing down except where there is obvious necessity for pruning. The whole thing represents simply an effort to combine the good points of the present practice with improvements that long experience proves are needed.

That the attempts did not produce a perfect code was to be expected; it was natural. It is the first time that a few men got enough gumption to endeavor to remedy the situation, but they need help, and inasmuch as Mr. Ray has pointed out the weak features of the act, he deserves our gratitude and good will.

He certainly put one over on us with that Webster proposition. We shall have to fall back on the World's Almanac. No wonder engineers have been trying to describe rock ever since the tower of Babel contract was let. Some contractors would agree with Webster when it comes to calling sand, rock. He must have been used to writing specifications.

It's a pity old man Webster when he described rock and earth was not as meticulous as he was when he was caught by the "missus" kissing the cook. Mrs. W., when she beheld him, said: "Noah, I am surprised," to which he opined, "No, it is I who am 'surprised,' you are astonished."

Indefinite Specifications

Mr. Ray points out that indefinite specifications have been so strongly condemned by the courts in New York that nothing remains to be done but to let the matter rest. It seems almost idle to argue on this point for the indefinite specification is the rule rather than the exception, and it is the most prolific source of graft and evasion and results in loss either to the city or municipality or to the contractor.

It is said that the law requires "definiteness" of specifications. If so, it is a dead letter, and it will remain so until a severe penalty is "handed out" to those responsible for breaking the law, and until some body makes it its business to see that the penalty is enforced.

It is true that, if the engineer does not know in advance exactly of what the work is to consist, he cannot tell the contractor. But then he should not expect and encourage the contractor to gamble on the chances that the work may not turn out worse than expected.

We have no sympathy for the contractor who deliberately takes a risk and who, if the chances are against him, kicks like a mule. On the other hand, we have in mind the contractor who is anxious to do good work—and there are many of them—who, we say, honestly endeavors to fulfill his covenant, yet, because of some studied vague clause of the specifications is obliged to make good when unexpected emergencies arise.

What we want is to have the risk for unknown conditions assumed by the proper party: the owner. Let the contractor do a certain known piece of work; no more, no less. Unit prices and proper specifications will provide the elements of certainty necessary to assure low prices.

Arbitration.

After all is said and done to improve present conditions it is a sure thing that some uncertainties cannot be definitely covered by specifications, and that disputes will arise. Many times these will be caused by the honest convictions of both sides, which happen to disagree on certain questions.

In that case, arguments should be submitted to arbitration. Not the often farcical arbitration provided by a choice of an arbiter by each party, the two chosen to select a third, but a permanent court of arbitration composed not of judges who have to depend on others for technical guidance, but of men who through training and experience are acquainted with the problems arising in construction work and qualified to solve them impartially. On this point we absolutely agree with Mr. Ray.

Don't Wait for Something to Happen.

On another point we also are in accord with Mr. Ray. That is, that nothing will be accomplished by contractors generally so long as most of them stand idly by expecting and hoping that some one else will object. Let them all come in with the engineers and discuss these questions, and once they lend their united support to a measure designed to improve the execution of public works, nothing can successfully oppose it. Then with their means of livelihood removed, the forces of graft and blackmail soliciting political contributions will cease to feed and fatten on the plunder extracted from the honest contractor by wielding over him the club fashioned from loose and one-sided specifications.

The Human Element in Public Contracting Law

By THOMAS H. RAY*

of the New York City Bar

A study of the history of the law in-so-far as it affects the "General Contractor," shows it to be a growth—the result of experience and necessity. Where a leak has been sprung in the public treasury by an over-ambitious contractor or public official, a legislative patch has been put on, perhaps at times somewhat disproportionate to the leak. And today the honest contractor who smarts under what he considers very restrictive statutes, is merely one more living evidence of the text: "The sins of the fathers shall be visited upon the children, unto the third and fourth generation."

The written contract is but a record of joint promises. And had all of your ancestors both in and out of public office been infallibly honest and capable, and had they demonstrated that their minds were sufficiently retentive to preserve all necessary details of their agreements without other record, they might by now have brought us to that utopian state, when long and ambiguous contracts will be a thing of the past, and restrictive statutes unnecessary.

But just as contractors and municipal officials still feel that they need the protection of a written contract against each other, so the general public feels that it still needs protection against both. The dishonest official can do little damage without the co-operation of the dishonest contractor. All contractors are not honest neither are all public officials. The division on the question of morals is probably about even. But no general legislation can inculcate morality. That is the work of the theologian, and until he has evolved the morally perfect man, the law must deal with the material at hand.

Furthermore, the business of general contracting is not always what might be called an exact science The nature and magnitude of the projects now being carried on do not permit of it being so. The very vastness of the enterprises undertaken demands that the work should be parcelled out in sections. And as the success of one section depends upon another, so is the work of one contractor dependent upon that of the other. A change in one section may require a change in all. Perhaps no one of such changes could have been foreseen. Then again the work may be sub-surface. But for whatever reason it is not always possible nor advisable considering the stupendous investments made to specify in advance unalterably and in detail of what the work is to consist.

Moreover contractors are supposedly business men. As in other fields of endeavor, there is the brainy contractor, the less brainy contractor, and occasionally a brainless contractor. They like others must assume those risks which are necessarily incidental to any business operation. And while at times the risk may seem great, so is the possibility of profit usually proportionately great to counterbalance any attendant risk. Strangely enough this circumstance seems to be perfectly satisfactory to the majority of contractors until something goes wrong. It is only then that they try to learn what the law is and if it inconveniently opposes them, they blame it for its obstinacy. They sign any sort of contract without reading it and when it bites them they feel grieved. But contractors are human and this is a characteristically human failing.

Recently a perfect mania for new legislation seems to have infected the nation and contractors have not been immune from the disease. The saddest part of the affliction is that those who are most ready to legislate do not know except in a general sort of way what they desire to accomplish. The basis of their action is merely that legislation is a panacea for all ills. Accordingly they often achieve a result quite the contrary to their intentions. And because of their beneficent efforts often some innocent victim is again started on his weary way through the courts in an attempt to learn just what the legislator "meant" to say, when he did not say what he thought he said, and when as a matter of fact he did not know what he was trying to say.

But legislation cannot inculcate morality; it cannot change the nature of the contracting business; it cannot enable engineers to see where they could not see before and it would probably be unconstitutional to pass a statute compelling contractors to read their contracts before signing them. Then why not pause before this mania for new legislation becomes too firmly implanted, in order that we may see exactly what the present conditions are? Just how bad is our law of today? Of what does the contractor complain? Is it the law and engineering or is it the lawyer and the engineer? If the root of the trouble is the law, is the law fundamentally wrong? Or do the annoyances spring from petty restrictions perfectly harmless when sanely construed but absolutely tyrannical when strictly enforced? When we have answered these questions then will we be in a better position to seek a remedy?

Not long ago a paper dealing with the defects in our present statutes and a proposed redraft of a general statute relating to public contracts, was published by this society. The complaints and proposed changes were grouped under five headings, as follows: Advertising, Specifications, Opening of Bids, Awards and Execution of Contracts.

It is manifestly impossible to examine all general and local laws which might conflict with the proposed law. That must be done by those locally interested in each case. But let us briefly examine the most important of these suggestions generally and in the light of the present law of New York, in order that we may see if that statute as judicially interpretated is quite as bad as it was therein painted, or whether the fault does not lie in the manner of its application by the city officials, the engineer, the contractor and the lawyer.

Any attempted legislation should be local in character in order to obviate the certain confusion and conflict of laws, which must necessarily follow any such general legislation as that proposed. And since the solution of your problems is to be more readily found in a study of municipal administrative law rather than in contract law the charter of the City of New York will be freely referred to.

The system of checks and balances incorporated in that instrument so far as it relates to this subject may well be used as a guide by smaller municipalities.

Bearing in mind the nature of the business in which you are engaged, and its uncertainties because of the occasional fallibility and lack of second sight on the part of the engineer, as well as the necessity for protection to the municipality, not only against the contractor but also against its own agents, let us determine in an unprejudiced way, wherein any improvement may be made in the law, which will bring about a more even balance in the scales, which weigh on the one hand the rights of the contractor and on the other those of the municipality. Remember also that the contractor, the engineer, the lawyer and the city official are human and that the law is a human agency.

ADVERTISING.

The general theory of the law relating to public contracts, is that a check shall be placed upon the authority of public officials in making expenditures of public funds. For obvious reasons such expenditures are prohibited, except as authorized by law. And in order to stimulate competition, prevent favoritism and secure the lowest price consistent with good work, it is required that all contracts for public improvements and supplies shall be founded upon bids secured in response to advertisements, and that the contract shall be awarded to the lowest qualified bidder responding. It is generally so required by the charters of the various cities in the state, as well as in the Second Class Cities Law, the Town Law and Village Law as now embodied in the Consolidated Laws of this state. Probably similar provisions are to be found throughout the country.

But while the wisdom of curtailing the authority of public officials is recognized, it necessarily follows that some discretion must be given to them in the matter of expenditures which they may be permitted to make in cases of emergency, without advertising for bids. Otherwise, by the time the necessary formalities had been complied with the emergency would either have ceased, or have taken on a complexion too serious to be described by even the term "emergency."

And various statutes in New York and elsewhere have been so drawn. In a city of the vastness of New York it has been found advisable to place the limit of discretionary expenditures at one, two and sometimes three thousand dollars. But the expenditures must always be accompanied by the certificate of the official making it, as to its necessity. The city is a tremendous enterprise and some faith must be lodged in its officers in order that its business may be carried on as a twentieth century civilization demands.

In smaller governmental units of the various states, the urgency of the emer-

* Memb. Am. Soc. Engr. Contr.

gencies is apt to be proportionately less, and the discretion extended to the officials, is correspondingly limited. This simply means if you wish to so interpret it, that the city, town or village carries its own insurance against the human frailties of its officers up to the amounts specified. The limitation to the amount of $500.00, as suggested, while perhaps a fair average is much too high in the case of the smaller towns and villages and much too low in the case of the city of New York. It would appear to be wiser therefore not to attempt to limit the amount of such discretionary expenditures generally throughout an entire state but to leave the amount to be fixed in each case according to the particular locality affected and by local legislation.

It has, however, been clearly determined by the courts that these discretionary provisions cannot be used for the purpose of tacking together a number of smaller contracts with a view to evading the general rule requiring the awarding of contracts upon competitive bidding. So there is no danger of any abuse of these provisions in this respect and no necessity for an amendment of the statute as has been suggested.

The objection has also been presented that insufficient notice of the intention to receive bids is given. This is also a matter of detail, for local attention. For example, the New York charter requires that such notice shall be advertised in The City Record for a minimum period of ten days prior to the time of the award. This does not appear to be an unreasonably short time in which to prepare the ordinary bid. Perhaps it may be insufficient for the preparation of bids on works of great magnitude. But they are usually under the supervision of special commissions, to whom this section does not apply. And was a contract for any great municipal project ever awarded without sufficient notice to those interested in bidding on the work? The more common experience seems to be that contractors are allowed to fret for months or even years in anticipation of the opportunity to bid.

The suggestion is also made that the call for bids should be more widely advertised, and in order to give every interested party an opportunity to bid, the officials advertising should be required to send out invitations broadcast. Your proposed statute even says: "All officials charged with the making of contracts or the purchasing of supplies shall keep in their offices various classified lists of contractors or dealers likely to bid or who request that their names shall be placed thereon; these dealers or bidders shall be sent by mail copies of the advertisements as soon as they begin to run."

A more appropriate place for such a provision would seem to be in the by-laws of your society, wherein are stated the duties of your Secretary, rather than on the statute books of the State of New York. Let him and not the State of New York run a card catalog bureau. What is your society for if not to help its members in just such a way as this? You at small expense could follow up the work to be awarded in the various departments of the state and city government and notify such of your members as might be interested in that particular kind of work, so also you could in your Journal advise members to be on the lookout for approaching advertisements. But the operation of such an employment bureau hardly seems to be an appropriate duty to impose on a state or a municipal officer.

Successful contractors will probably agree that alertness and ability to get business are important factors in success. Business is not wafted in the window, but must be gone after determinedly and even then it is apt to be elusive. The contractor who is not enough awake to know where to look for advertisements and to know in advance of their coming is deserving of scant sympathy.

It is also proposed that where contracts in amounts over one hundred dollars and under five hundred dollars are to be made three informal bids shall first be obtained in order to insure competition. If a public official cannot be trusted to honestly expend five hundred dollars in his discretion would the necessity of three informal bids make him honest?

And wherein do your words: "The information for bidders shall be clear and free from repetitions and shall cover all information necessary for the submission of a proposal and the preparation of an accurate estimate for the construction work and to properly construct the work or furnish the supplies as specified," improve upon the wording now commonly in use: "They (the proposals) shall state the quantity and quality of supplies or the nature and extent as near as possible of the work required." (Section 511, N. Y. City Ordinances).

How great a difference is there between "all information necessary" and "as near as possible"? Someone must decide what is necessary just as he now decides what is possible. Suppose you disagree with the official interpretation of necessity, what could you do about it that you can not do now? To assume that the engineer or specification writer can give information which he does not possess and cannot obtain does not help matters. You cannot compel the impossible by merely writing a new statute.

So also you suggest Noah Webster as the court of last resort and decree "words shall be used in their meaning as specified in Webster's Dictionary." Listen to the assistance that Webster would give in making your specifications more definite as illustrated by a few of his definitions selected at random:

ROCK—1. "A large concreted mass of stony material." 2. "Any natural deposite forming part of the earth's crust, whether consolidated or not, including sand, earth, clay, etc., when in natural beds."

EARTH—1. "The solid materials which make up the globe in distinction from the air or water." 2. "The softer inorganic matter composing part of the surface of the globe in distinction from the firm rock."

REQUIRE—1. "To demand, to insist upon." 2. "To demand or exact as indispensable, to need." 3. "To ask a favor, to request."

Evidently Webster believed in playing safe to the same extent as our more modern specification writers. Certainly he leaves a reasonable ground for a slight argument.

SPECIFICATIONS.

The chief objection offered against the present law relating to specifications, appears to be that all bidders are not required to bid on the same work; that they are indefinite and permit of favoritism not only at the time of the award, but thereafter. The indictment reads: "Perhaps the most important thing to be required in specifications is that all bidders must bid on the same thing and know exactly what it is to be before bidding. This strikes at the very foundation of present customs."

Only a few citations should be necessary to convince the most dubious that no new statute is necessary to bring about this much desired result. Indefinite specifications have been so strongly condemned by the courts in New York and have for so long a time been legally dead and buried that nothing remains to be said but "respice in pacem."

Perhaps the most recent obituary was delivered by the New York Court of Appeals in the case of Hart v. City of New York, 201 N. Y. 45. There outside of a few definite requirements, the contractor was allowed "to select any method of sewage disposal and construct and arrange buildings, appurtenances, such as tanks for sedimentation, filtering pipes and valves, foundations, engines, boilers, etc., according to any system he desired and according to plans and specifications to be submitted by him with his bid."

The court said: "It is apparent from this general statement how indefinite was the description of the work to be done and how practically impossible it was for bidders to compete with one another on a common basis of work to be done and materials to be furnished and how open to discretion and judgment of the municipal officers it was to determine which was the lowest bid. * * * It seems clear that such purported specifications cannot possibly furnish the basis for real competitive bids, which may be subjected to an intelligent and uniform test for the purpose of determining which is the lowest and therefore with the statute."

The court suggests that where there is a possibility of various different standards or systems such as in this case, the municipal officers must do one of two things. Either they should adopt the most promising system or else assuming that it is permissible to call for bids on any one of different systems, plans and specifications should be adopted applicable to each system upon which bids are to be received. (See also Luther v. Briggs, 64 N. Y 404).

So in People ex rel Ream Pavement Co., v. Board of Improvement, 43 N. Y. Supp. 227; the board advertised for four or five different kinds of pavement. Ten bids were received but no two for the same kind of work. The specifications were condemned and the rule stated: "Work should be done in such a way that the lowest bidder could be determined by calculation without any exercise of judgment as to the relative advantage of different kinds of pavement."

Again in People v. Scannell, 82 N. Y. Supp. 363, the following appears: "The only test of bids made under the charter is that of price. It is the duty of the commissioner inviting bids for supplies to clearly indicate by standard, description, test or sample, the kind and quality of goods which he requires. Every bidder will be presumed to offer goods of the kind and quality thus indicated and thus the price at which each offers to supply such goods affords the only standard by which bids can be compared to ascertain which is lowest."

The law also prevents any tampering with bids after the opening (Dickinson v. City of Poughkeepsie, 75 N. Y. 65); likewise fraudulently unbalanced bids; (Mayor v. Brady, 115 N. Y. 599: Mat-

ter of Anderson, 109 N. Y. 557), bids stifling competition and favoring a monopoly, even where petitioned for by the property owners. (Boone v. City of Utica, 26 N. Y. Supp. 932).

On the other hand, the officials are allowed some discretion in reasonably restricting bids by requiring a sample where an untried article is offered; (Section 517 N. Y. City Ordinances); or in specifying the use of a particular kind of article where it is of generally recognized excellence and is but a component part of a large undertaking—such as a particular kind of steel in a bridge; (Knowles v. City of New York, 75 N. Y. Supp. 189; 176 N. Y. 430). In the latter case, however, the work was carried on by a commission especially organized for the purpose and who were not restricted by the provisions of the charter.

And why should not some discretion be allowed to the city officials in these respects? The public needs protection against skyrocket contractors, as much as the contractor needs protection against dishonest officials, and the law is merely a human attempt to strike a fair average of safety between the two dilemmas.

Do not attempt to make it too rigid or someone may try to use it as a boomerang against you. Thus in New York there is a provision that bids are to be dropped in a bid box provided for the purpose of receiving bids on each kind of work advertised for. A contractor once dropped his bid in the wrong box. A brother contractor sought to nullify the entire proceeding on this ground, well illustrating another human characteristic to be considered in framing a new statute.

The court, however, decided that the error was a mere irregularity which did not nullify the bid and might be waived, saying: "All provisions both of the statute and of the rules and regulations which have been adopted for procuring genuine bids and responsible parties are in the main for the benefit of the city and in order to prevent frauds upon it. They have not been adopted for the benefit of the bidder but for the protection of the city and it necessarily follows that the city to some extent at least has the right to waive irregularities, when it is clearly for its benefit so to do, and when no damage will be inflicted on it or wrong done to others thereby." (McCord v. Lauterbach, 86 N. Y. Supp. 503).

Another interesting question has been raised as to the proper method to be pursued when the municipality desires to use an article the right to manufacture which is covered by a patent. The statutory provisions relating to this subject do not show any intention on the part of the legislature to prohibit municipal corporations from having the benefit of patented articles, but to make necessary that those patentees offering the benefit of their patents to the city should be compelled by competing with others to keep within reason the profits accruing from such patents and to thus prevent a fraudulent mulcting of the city treasury.

But this result cannot be accomplished by providing in the specifications that the patentee will supply the patented article to the successful bidder at a price fixed by agreement with the city. The effect of such an agreement is directly the opposite to what the statute aims to accomplish, for the patented article is thus withdrawn from competition entirely. The courts have so decided and have also held that if the specifications are so written as to require that a certain result must be arrived at and which can be arrived at either by using the patented article or otherwise and without prescribing that the patented article shall be used, then the patented article is brought into competition with the others and if the patentee is then the lowest bidder he should be awarded the contract.

But suppose such specifications were used and the patentee was not the lowest bidder? If the public interest so demand the contract may still be legally awarded to the patentee, in a properly organized and administered municipality and in a manner which will protect the interests of both the other contractors and the public.

Thus in the New York charter it is provided that all contracts must be awarded to the lowest bidder unless it is decreed otherwise by a three-fourths vote of the Board of Estimate and Apportionment. So that if the patentee were not the lowest bidder and it still appeared not only to the head of the department making the award, but also to a sufficient voting majority of the eight members of the Board of Estimate and Apportionment that he should nevertheless have the contract at his own price, it might be awarded to him.

With this system of checks, if you still feel there is danger that almost the entire city government will be corrupted by the contractor, then there is necessity for an amendment to the statute. But while amending why put more faith in the affidavit of a patentee that his price to the city is as low as to any other purchaser, than in the discretion of nine city officials who have already sworn to enforce the law?

OPENING BIDS AND AWARDS.

The chief objection urged against our present statute seems to be that the fact that bids are called for is no assurance that an award will be made. The present system permits of the rejection of all bids and a readvertisement, although if any award is made it must be to the lowest bidder. It is urged that this is an "Open Sesame" to easy money. You say if the favored contractor is not the lowest bidder then it is only necessary for the official to reject all bids, readvertise and continue the process until his favorite happens to be the lowest bidder, so that an award may be made to him.

Your suggested remedy is to provide that in all cases where an award is not made, that the lowest bidder shall forthwith become entitled to collect damages from the city equal to the amount of the bond required to secure the execution of the contract, i. e., from ten to thirty-three per cent of the contract price. But if you fear connivance between city officials and contractors why go out of your way to guarantee to them as you would by this change, that every time the favorite bidder is lowest, he shall have the full profit on the job without doing any work? Don't you see that the official need then only reject all bids every time his friend happens to be lowest bidder and the contractor could then collect his profit without turning a hand? Such suggested change would not then go very far toward correcting the abuses of which you complain, and the present method is not so bad after all. Likewise your suggestion that if "only one proposal is offered, no award shall be made" is manifestly bad.

But why should the city be compelled to accept the lowest bid or any other bid? The bid is merely an offer. No one compels the contractor to bid. The private individual advertising for bids does not guarantee to make an award. Circumstances may arise which make it advisable for him to abandon the enterprise; or he may decide for good and sufficient reasons that he should accept other than the lowest bid. Why should any different rule apply to the city? Circumstances may arise which recommend a a change of plans. Should such change be made impossible save at the expense of paying a contractor full profit merely for preparing a bid? Surely the greatest length to which anyone could ask the city to go would be to allow a fixed sum as compensation for the expense of preparing the bid, as is sometimes done where architects compete; but there would seem to be small justification even for such a provision except on large undertakings, where the preparation of the bid is attended with considerable expense.

The provisions of law regulating the opening of bids in New York may also be examined with some profit.

There the centralization of power is found in a Board of Estimate and Apportionment, which annually receives the estimates of required expenses for each of the administrative bodies having in charge the various branches of the city government, and apportions to each the amount necessary in the judgment of the board for its maintenance.

The repeated admonition that no expense shall be incurred unless appropriation shall have been previously made therefor and that no valid claim against the city can arise or exist in excess of the amount appropriated for the special purpose, makes imperative that every contract to which the city is a party shall come directly or indirectly under the scrutiny of this board.

Thus the contract may be incepted in any of three ways:

1st. By resolution of the Board of Estimate and Apportionment (Sections 242, 243 and 169, N. Y. Charter).

2nd. By ordinance of the Board of Aldermen and concurring resolution by the Board of Estimate and Apportionment (Section 47, N. Y. Charter).

3rd. By resolution of the "Local Board" of improvements upon petition and the concurring resolution of the Board of Estimate and Apportionment (Sections 426 to 434, New York Charter).

Accordingly the general rule may be stated that no valid contract can be formed unless the money to pay the expenses to be thereby incurred shall have been previously appropriated.

In conformity with this principle, similar provisions are found in the Second Class Cities Law; the Village and Town Laws, limiting obligations on contract to the amount previously appropriated.

It is to be noted that the law does not require that the actual cash to meet the payments which may grow due under the contract, shall be in hand at the time of the execution of the contract. The interests of the city may best be guarded by not issuing the bonds or corporate stock in advance of the consummation of the contract and paying interest thereon during the periods when the money is not actually needed.

You would require that an appropriation be made before bids are requested. Since the fallacy of the suggested provision that an award must be made each time

bids are received has been shown, there is no necessity for any change in the present statutes.

The law quite generally requires that the terms of the contract shall be fixed and approved by the legal officer of the municipality before the bids are advertised for (Section 419, New York Charter); and that the bids shall be delivered in a sealed envelope which shall not be opened until the day designated. And the bids must be publicly opened by the officer advertising, in the presence of the financial officer of the city (Sections 513-516, City Ordinances, Section 419, New York Charter). The courts have decreed that these provisions must be strictly complied with. To use the language of the court in the case of People ex rel. Rodgers v. Coler, 56 N. Y. Supp., 875: "These provisions are salutary in their nature, and intended to prevent the manipulation of bids before they come into the hands of the officer who is to report the same to the comptroller."

It has already been noted that if any award is made it must be to the lowest bidder unless the case is especially excepted by the Board of Aldermen or the Board of Estimate and Apportionment. The law is equally well established that by the term lowest bid is meant the lowest bid submitted in compliance with the statute at the time of opening and not a bid which becomes lowest by the withdrawal of others, since the statute does not permit of such withdrawals.

There are, properly, exceptions to these rules both by statute and by judicial decree. Thus Section 514 of the New York Charter permits the Commissioner of Street Cleaning in certain cases to award a contract to other than the lowest bidder, provided he secure the approval of the Board of Estimate and Apportionment to his selection, and it has been decided that it is for such board to examine the terms of the contract and to approve or disapprove of it. The commissioner is also permitted in case of a snow-fall to hire "so many men, carts and horses, as shall be rendered necessary by such emergency." Would you withdraw such discretion or a similar discretion of the Department of Health, or require that if such commissioners wished to expend five hundred dollars that they should first secure three informal bids and prohibit any expenditure where only one bid was received?

The courts have also decided that the provisions of the statute requiring the awarding of contracts after competitive bidding do not apply in cases into which an element of personality enters, such as where contracts for professional services, are to be made. However, in New York, the same result which is accomplished by the latter decisions may be arrived at in a regular and orderly way by resolution of the Board of Aldermen excepting the case from the general rule under the provisions of Section 419 of the Charter.

It is not pretended that we have had here that full discussion of the statute which the importance of the subject warrants. But sufficient has been said to demonstrate that, even though perfection be not claimed for the present laws, that no radical wholesale legislation should be attempted without a more careful study of its possible effect.

Had you the opportunity to write anew our entire system of government and jurisprudence, no doubt with careful study you might improve upon it. But since you are repairing instead of building anew, you must accept conditions as you find them, and build thereon.

As has been intimated, the provisions of law relating to public contracts are not to be found in any one statute, but are in New York necessarily interspersed among the various city charters and ordinances, the General Municipal Law, the Second Class Cities Law, the Town Law, the Village Law, the County Law and the corresponding statutes in other states. No legislation should, therefore, be attempted without careful consideration being given to its effects upon these existing statutes and an examination of all local conditions, lest that by reason of a probable resulting confusion, conditions be made worse. The possibilities of such confusion are well illustrated in the draft of your proposed law, wherein you refer to section 62 of Lien Law. This statute was repealed in 1911—almost immediately after its enactment.

Nor for the same reason should any attempt be made to formulate a nationally uniform statute. There does not appear to be that necessity for such an attempt which existed for example, for the adoption of a nationally uniform statute regulating the use of negotiable paper, recently adopted in most of the states.

A note may be negotiated to one residing in a state other than that of the maker. With different statutes prevailing in each state, one could not safely accept such paper without an examination of the law of the state in which it was made. But no such urgent reason can be advanced for standardizing the statutes relating to public contracts. The work of public contracting is not inter-state business. It must be confined to the particular locality in which the contract was entered into. And the statutes providing for the formation of public contracts must necessarily vary with, and correspond to, the diverse forms of local government now in vogue.

The foundation upon which you must build has been briefly outlined. The law requires definiteness of specifications, and a statement "as nearly as possible" of what the work is to consist. But "definiteness" of specifications presuppose something definite with which to start. If the start is clouded in indefiniteness the finish will be more so. If it is impossible for the most skillful engineer to know in advance exactly of what the work is to consist, it necessarily follows that he cannot tell the contractor. Reams of legislation will not make the engineer wiser. Why not recognize this fact and make the best of it? No law can change this condition of affairs and two courses are open to you.

First: You may quit business; become employees and let the government do all work by civil service or day labor, and ask that you thus be guaranteed your profit.

Second: You may retain your business independence, admit the facts and devise that system of arbitration which most nearly approaches the ideal, considering all human weaknesses of both contractor and engineer; not that system which is theoretically perfect but which assumes perfection in humanity in general and the city's engineer in particular. The latter assumption is the difficulty with the present common practice of designating the city's engineer as absolute arbiter on all questions arising under the execution of the contract. It is unsatisfactory in that it appears to deprive the contractor of his day in court, until it is too late to be of full benefit to him.

The system which permits each party to the contract to select an arbiter, and those two to chose a third, while theoretically good has not always proven satisfactory in practice, because of the long delays pending a decision, the unstability of the decision when reached, and has given rise to an abundance of litigation.

The ideal system would be one which permitted an optional appeal from the decision of the city's engineer to a disinterested competent and permanent court of arbitration whose decision on the matters in dispute would be speedy and final and made known before the completion of the work. No change from the present system which does not tend to accomplish this ideal of a quick and final decision should be considered.

In large communities such as New York a Court of Arbitration might be created for the sole purpose of passing upon questions growing out of the execution of municipal contracts and to decide optional appeals from the decision of the municipal engineers, its decision to be final. The advantage to be derived from such a forum would be a rapid and final decision, and, therefore, unless the facts were practically undisputed this suggestion might not be practical.

Leaving aside all questions of the revision of laws, what can such organizations as this society do *now* to make the life of the contractor less burdensome?

You should seize every advantage which the law gives you by reason of your united strength. So long as you meekly accept any form of contract presented to you so long will you have to do so. Numerous clauses are found in contracts which no law compels to be inserted therein, but which no law prohibits. There is no justification for them but habit, and they remain because no united stand is taken against them.

We have seen that the contract must be prepared and approved by the legal representatives of the municipality. Therefore, the time to object to it is before it is approved; the time to read it is before it is signed. Perhaps you feel that you would experience difficulty in securing permission to make such examination before its approval. If an individual attempted to so intrude his personality into the matter this might be true. But that is the very reason for this and other similar organizations. There is no conspiracy of public officials against the contractor. Public officials are fast learning that they are the servants not the masters. Therefore, make certain of the justice of your position before you assert your claims. If they are well founded, if you can show that a contract is unnecessarily harrassing and unfair to the contractor with no corresponding advantage to the city, if it is ambiguous and you can make it clear, your rights must be recognized and a proper measure of relief given.

But you must talk in particulars not in generalities. For years it was required by city ordinance in New York that each bid should be accompanied by an undertaking to the effect that the contract if awarded to the bidder, would be faithfully performed. Such a provision was entirely unnecessary and was quite generally disregarded except as to form.

The General Contractor's Association singled this provision out as a target and secured a repeal of the ordinance. But they were able to point out, that while it was a small matter, it gave rise to much unnecessary annoyance to the contractor with no benefit whatsoever to the city.

Had they merely raised a general shout that the contractors were oppressed without being able to point out how and where, they would have accomplished nothing.

So there are provisions which are commonly incorporated in municipal contracts which should be singled out, one by one for attack. Thus an attempt should be made to secure more reasonable provisions for the prompt inspection and approval of work; likewise the provisions with reference to the commencement of the time of guaranty, and the provisions for the compensation to the contractor in cases of delay by causes beyond his control.

Also since the municipal engineer is so important a factor in your lives, since he may work so much for good or evil, lend some of your attention to him. If any one of them has demonstrated his unfitness, resulting not only in inconvenience, but possibly in loss of the contractor, do not stand idly by hoping that someone else will object. Insist that the city is entitled to the services of the most competent engineers available; take interest in their selection, and follow their work thereafter. If you fear retribution from such action on your part, use the shield of this society for protection.

Only in such a way can it be hoped to secure the most prompt and permanent results. Be mindful of the fact that it has taken years to bring about the conditions of which you complain. Therefore, do not seek to make all things over in a day. Get first a clear survey of the general situation. Demarcate the good from the bad. Make certain of your remedy before you condemn. Your office is to repair—not to destroy—to clarify not to confuse.

The discussion of this paper will appear in a later issue.

ENGINEERING LAW

ANSWERS BY WILLIAM C. BOWMAN, C. E.

Attorney at Law, Member of the Society

QUESTION. We are a New York corporation and have taken a contract with one of the Pennsylvania State departments. For several months we have gotten along finely with the Commissioner, but due to circumstances which need not be stated we are now in trouble with him and he is making our contract cost more than we will receive, by his arbitrary orders. He does not seem to understand the contract and its specifications and has in the past had us make numerous changes and construct extra work without written orders, etc., and he now refuses to pay us for that work or for any of our losses caused by his ignorance and that of his architect. Have we any redress and how would we proceed to get our pay for such work?

ANSWER. Unless you are politically strong in Pennsylvania there is no way in which you can enforce your rights. The State is a sovereign body and can only be sued in the way permitted by its legislature. In Pennsylvania you must first secure permission of the State Legislature before you can sue the State. If the particular Commissioner you are dealing with will not do something for you on your plea for justice and equity, you have little or no hope of recovering for the losses and extra work you mention. This difficulty is obviated in many States by the formation of a court or board of claims. This seems to be a case where you may have to make the best of an unfortunate position where you cannot enforce even your contract rights.

QUESTION. We have just completed a contract for the City of New York. Somewhat in connection with the contract work we received a Borough President's order for $750 for work not in our contract. The city is ready to make the final contract payment, but I know I will have to sign a general release. How will that effect the $750 order which has been held up in the Comptroller's office?

ANSWER. In signing your release you had better make an exception to the order mentioned so that later on there will be no question as to whether or not the release covered such order. The City of New York by its Corporation Counsel has been known to put up such unexpected and inequitable defenses, and in order to prevent such a difficulty and the resulting trouble and expense you should always make as many exceptions in your releases with the city as you can get, even though in your own opinion they may seem unnecessary and foolish.

QUESTION. Is there any distinction between extra work and additional work?

ANSWER. The New York cases make a distinction between extra work and additional work; extra work being defined as work outside of and entirely independent of the contract and not required in its performance, and additional work being work necessarily required in the performance of the contract and not reasonably implied therein and yet evidently necessary to the completion of the contract work. In other and more simple words it may be generally stated that extra work is work of an entirely different nature than the contract work, while additional work is work of the same nature or units as called for in the contract. In some of the New York City contracts this distinction must be carefully noted as there are different requirements necessary before a contractor can recover compensation for either of these classes of work.

Additional work as differentiated from "alteration" work is defined in some statutes as a lateral addition or a change in a structure so that it occupies more ground.

Due to the fact that these terms are often used together in a contract clause, it is probable that generally and popularly they are and will be considered to mean the same thing. If they are used to mean different classes of work they should be clearly defined in the contract.

EMPLOYMENT BUREAU

Actuated by a desire to be of direct assistance to all of its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

MEN AVAILABLE.

001 Member of the Society with twenty-six years active experience would like position as Superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

002 Member of the Society with twenty-seven years' experience as Superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent preferably in the East. Best references available.

THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume 2 NEW YORK, JANUARY, 1914 Number 1

Something for the Contractors to Think Over

IT has been said that there are three kinds of honesty — just plain honesty, business honesty, and contractor's honesty, the third being almost unknown.

What a reflection on the contractors!

In spite of the fact that ninety per cent. of the contractors are really honest why does the public consider grafter and contractor as one? Who is to blame?

Neither the political highbinder, nor the crooked contractor, but you, the honest contractors.

Once in a while the people are aroused, and we are then treated to a disgraceful exhibition of political holdups, such as are now being exposed in New York State. The crooks dug and grubbed everything, everywhere, Roads, Canals, Aqueduct, Prisons, looted far and wide. The filthy piracy was going on unchecked until a patient and careless public was nauseated by the stench of corruption.

The "system," however, will go on serenely, because newspapers will soon have other matters to bring before the public, and the whole nasty business will be forgotten; the only thing that people remember is that close connection between grafter and contractor.

Even the political crook despises the contractor. For here comes along Richard Croker of odorous fame writing to some friend about the necessity of reforming the Hall. "I hope some good man will get in and drive all of them (sic) grafters—contractors out."

Just as we said before, some people think that contractors and grafters are the same species. Who would have thought this of Dick?

Is there any reason why such a state of affairs should continue to exist? Certainly not.

Does anyone believe that graft would be demanded of honest contractors if they were banded together in a strong organization ready and able to fight "the system." They would no longer have to fear the bad will of the politicians and of their tools, be they dishonest engineers or public officials.

The grafter will shrivel to nothing if he is subjected to the powerful searchlight of publicity blazing on his filthy trail. The remedy is at hand, but it will avail nothing unless reinforced by the resources of numbers.

We are strong only as we stand together; alone, we are weak indeed.

The American Society of Engineering Contractors is for the honest contractors; it needs them and they need it. Get identified with this, the only national organization for contractors and all interested in contract work. Help in the good work. We desire to show that honest contractors are determined to stamp out looting and graft in public works.

As ELBERT HUBBARD says: "*We are bound up in a common bond of brotherhood, and only as we recognize and respect this brotherhood are we able to get out of our shells.*" *So it's altogether, all of the time.*

FIFTH ANNUAL MEETING

OF THE

American Society of Engineering Contractors, Inc.

Report of the Secretary

As required by the By-Laws of the Society I submit herewith my annual report as Secretary for the year 1913:

The following table gives an accurate record of the changes in membership during the year 1913:

Membership

Membership.	*Hon.*	*Mem.*	*Jun.*	*Asso.*	*Total.*
Jan. 1, 1913	1	580	46	7	634
Elected 1913	..	45	1	1	47
Transferred 1913	..	3	..	..	3
Totals	1	628	47	8	684
Deaths	..	1	..	..	1
Resignations	..	31	3	..	34
Dropped	..	8	2	..	10
Totals	..	40	5	..	45
Membership Jan. 1, 1914	1	588	42	8	639

The above table shows that the total increase in membership for the year 1913 was 47, including 45 members, 1 junior, and 1 associate. It will be noted that this increase is not equal to that for 1912, when a total of 92 members were added to the rolls. However, the total loss in membership during the past year was only 45, including 1 death, 34 resignations and 10 members dropped for non-payment of dues. Poor business and its attending financial depression during the past year was, undoubtedly, the cause of the comparatively small increase in the membership of the Society.

New Members

During the year 1914 I will make every effort to secure a large number of new members, and I desire the co-operation and assistance of every member of the Society. If each one would make it his business to secure at least one new member we should at the end of 1914 have a membership list numbering over 1,000. This would be very encouraging, and also beneficial to the finances of this Society.

It is therefore hoped that a large number of members will come out of the ether and arouse themselves to enthusiastic efforts in a campaign for a larger membership that will establish a record for this Society.

Transferred

Members transferred during the year 1913 from junior membership to full membership are as follows:

Edmund A. Pratt, New York, N. Y.
John W. Sheridan, Regina, Sask., Canada.
Gustav A. Unversagt, Brooklyn, N. Y.

Deceased

Only one loss by death was reported during the year:
F. O. Blake, Los Angeles, Cal.

Publication

During the year 1913 eight copies of the Journal were published, six were printed in the old form under the name of the "Journal of the American Society of Engineering Contractors," and the last two, namely, the October and November issues, in the new and improved style, under the name of "The Engineering Contractor.

The size of the former journal was six by nine inches. The Engineering Contractor, our new publication, is nine by twelve inches, the standard size of technical publications. The enlarged size permits sufficient display space for illustrations and advertisements and altogether provides a more satisfactory medium for the publication of the Society's activities.

All the changes in the present publication were adopted to make it attractive, readable, unique, and, above all, influential.

The first step in the process of improvement was to select a title that would indicate the character of the membership of the Society, and which, at the same time, would be brief, snappy, neat, and easy of reference. The present name was picked out of several that had been suggested and so far as I have heard from members of the Society, the change has been welcomed.

The Engineering Contractor will contain as little as possible of the matter that may be found in other technical papers. No strictly scientific or theoretical technical articles, no historical or general engineering essays, will be printed therein. In other words, no attempt will be made to add to the enormous amount of material of this kind found in older publications that are better able to gather and disseminate the same.

On the other hand, prominence will be given to articles, discussions, and news relating to specifications, costs and methods, managements, and to the legal and business end of contract work.

Library

Owing to lack of space the Library has not been enlarged to any great extent during the past year. It comprises at present over fifty bound volumes, some two hundred unbound volumes, and a quantity of drawings, photographs, specimen contracts and specifications, etc. Several additions have been made to the exchange list, however, and the Society has now on file in its reading room about eighty of the principal technical publications.

Advertisements

Our advertising income for the year 1913 was $879.55, which shows an increase of $555.70 over last years' advertising receipts. This is more than double the amount received during 1912, which was $323.85. There is still outstanding $185.70, which makes the total income from advertisements printed in 1913 $1,065.25.

Our advertising department is now in the hands of a competent man with experience in this line of work.

The department in his management should expand very rapidly, and at the end of the next year we expect to submit a report of which we shall feel justly proud.

The growth of the advertising section of the Journal is one of the surest ways of increasing the revenue of the Society, and it is hoped that every member who can do so will assist in the building up and broadening out of the advertising department.

Committee Work

The committee work for the year 1913 will be discussed and commented upon during the latter part of this session, when the reports will be read

Conclusion

In concluding this report I desire to make a strong plea for co-operation and assistance from every member in the Society, not only in securing new members, but in their attendance at meetings and their participation in discussions. Every man has had experiences that would prove interesting to others and that are worth knowing. Let them contribute articles and information for publication in the Journal. If the members will lend their hearty and enthusiastic aid in these respects during the present year excellent progress will undoubtedly be made, and the American Society of Engineering Contractors will then speedily take its place as the foremost Engineering Contracting association in this country.

Report of the Treasurer

Financial Report for the Year 1913

Submitted by

CHILD & SMITH Certified Public Accountants, New York

American Society of Engineering Contractors,
11 Broadway, New York, N. Y.

Dear Sirs—Having completed the examination of the accounts of your Society, covering the transactions of the period of twelve months ended 31st December, 1913, we desire to submit hereinafter the following:

Statement of Assets and Liabilities at 31st December, 1913, together with statement of Income and Expense for the period of twelve months ended the same date.

The Financial Statements should be of interest in indicating the progress being made by your Society. Assets increased during the year $2,500, whereas Liabilities decreased $700, making an improvement of $3,200, or the amount by which the Surplus was increased.

With reference to the comparative Income and Expense accounts, your attention is directed to the discussion that followed the submission of the Treasurer's statements for 1911, as printed on pages 47 to 50 of the January, 1912, issue of the Journal; the economies promised at that time certainly appear to have been realized.

It will be noted that the Income Statement for 1913 shows that $5,800 as Income from Members' dues, while the Balance Sheet indicates that $5,400, covering several years dues, remain unpaid; an amount almost equal to the entire dues for 1913. The unpaid dues for 1911 alone, if collected, would discharge all your Liabilities at the present time.

The examination made by us was thorough and covered fully all the financial operations of your Society; no attempt, however, was made by us to verify independently the amounts shown to be due by members or by advertisers; perhaps such a verification at some future time might prove beneficial in stimulating your members to remit rather than to confirm that they owe the money.

Yours very truly,
(Signed) Child & Smith,
Certified Public Accountants.

American Society of Engineering Contractors Statement, Assets and Liabilities. Periods Ending 31st December

Assets

	1913.	1912.
Cash	$ 150.46	$ 40.09
Accounts Receivable:		
Members' dues	5,406.00	3,463.00
Members' entrance fees	285.00	255.00
Members' badges	19.00	6.00
Advertising	185.70	.....
Inventory:		
Stationery and printing	207.00	.....
Badges	5.25	.....
Furniture and fixtures	276.90	276.90
Library	100.00	100.00
Totals as below	$ 6,635.31	$ 4,140.99

Liabilities

Accounts Payable:			
Invoices, 1912	$ 773.12		
Invoices, 1913	1,545.73		
		$ 2,318.85	$ 2,442.62
Dues paid in advance		55.00	100.00
Notes payable—Stirling Press		.....	500.00
Loans payable		187.00	207.00
Due members on certificates		24.00	23.00
Due St. Louis branch		46.75	46.75
		$ 2,631.60	$ 3,319.37
Surplus ending of period as annexed		4,003.71	821.62
		$ 6,635.31	$ 4,140.99

Comparative Income and Expense Account. Periods Ending 31st December

Income

	1913.
Dues—Members	$ 5,824.00
Life members, 10 at $100 each	1,000.00
Entrance fees	200.00
Subscriptions	4.00
Badges	71.50
Publications	101.78
Advertising	879.55
Total income	$ 8,080.83

Expenses

Journal—Cost of printing 10 issues, 12,689 copies, at .1148 each	$ 1,475.37
Journal cuts, halftones, etc., net	74.06
Stationery	105.88
Postage	266.25
Rent	450.00
Telephone	86.72
Traveling expenses	70.00
Salaries—Officers	240.00
Clerical	1,100.25
General expenses	484.61
Badges purchased	27.30
Advertising commission	225.80
Expense of meetings:	
Rent	105.00
Stenographer, January and February meetings	117.50
Slides, net	51.50
Total expenses	$ 4,880.24
Net income transferred to surplus	$ 3,200.59

Surplus:		
Credit balance beginning of period		$ 821.62
Add net income for period as above		3,200.59
Deduct net loss for period as above		.....
Deduct adjustment applicable 1912 net		18.50
Credit balance ending period		$ 4,003.71
Adjustments:		
Credits—Advertising		$ 154.10
Debits—Officers' salary	$ 170.00	
Advertising commissions	2.20	
Cash discount	.40	
		172.60
Net debit as above		$ 18.50

COMMITTEE REPORTS

A-1 on Public Construction Contracts

The undersigned, chairman and sole member of Sub-Committee A-1 on Public Construction Contracts, presents the following report:

The principal activity of this sub-committee has been in connection with the work of the Committee on Contracts in the revision of the proposed act to amend the general municipal law in relation to forms of public contracts. Little beside correspondence has been undertaken in the direction of securing an improved and uniform form of public contract, the chief work within the cognizance of this sub-committee. It had been hoped at the close of last year that conditions in Washington would be favorable for a discussion of this subject with officers of the national executive departments. The subject had been once considered by a special departmental committee appointed by President Roosevelt and later by the Commission on Economy and Efficiency under the direction of President Taft.

Early in the present national administration it was decided that this commission should not be continued. When it went out of existence on June 30, 1913, there was no one specially charged with the consideration of the general subject of the forms of public contracts, as applicable to the various departments. Any effort for the improvement of these forms would necessarily be addressed separately to the departments having to do with public construction contracts. It was not thought desirable to attempt this so near the beginning of a new administration, when many difficult questions of personnel and policy necessarily have to be solved.

Your sub-committee has observed a growing public recognition of the necessity for a reform in public construction contracts to the end of reaching greater certainty in contracting. Chief among the movements to this end has been that initiated by H. L. Lewman, of Louisville, Kentucky, in the Builders' Exchange of that city. That organization proposed the following as its objects:

> "To accurately define and standardize, wherever practicable, plans and specifications in order to eliminate unnecessary hazards and uncertainties in construction contracts.
>
> "To reduce the cost of improvement to the owner.
>
> "To give the contractors and surety companies a proper understanding of the obligations they assume.
>
> "To establish contracting and suretyship on a more stable and definite basis.
>
> "To provide for the settlement of differences by some equitable constituted authority.
>
> "To establish building contracts on such a basis that banks and commercial institutions may intelligently determine the amount of credit to be extended to owners and contractors and to eliminate the present uncertain conditions of credits based on such contracts."

Among the many authorities cited in support of these principles are the papers submitted to this Society by Major C. E. Gillette, formerly its president, and by this sub-committee and its chairman.

An elaborate pamphlet has been issued by that association, in connection with the National Building Trades and Employers' Association of America, of which Mr. Lewman is vice-president. This states that the movement has been endorsed by the Association of Kentucky Surety Agents, by the Surety Association of America, by the National Association of Credit Men, and by over one hundred organizations of builders and commercial interests in the United States, as well as by numerous individuals.

Your committee has been in correspondence with Mr. Lewman and the secretary of the Builders' Exchange at Louisville, and hopes to find some method of co-operation to the common end of the various organizations interested. Copies of this pamphlet can be obtained by application to J. M. Vollmer, secretary, Builders' Exchange, Louisville, Kentucky.

Your sub-committee has viewed with great satisfaction the co-operation of two representative surety associations in this movement, one local and the other national in its scope. It is your sub-committee's opinion that the most effective source for reform in regard to the provisions of public contracts is through the surety companies. They have met many serious losses in construction contracts and most of them realize to the fullest extent the necessity for engineering and architectural contracts being freed from the broad discretionary provisions and the many uncertainties now found.

In response to a suggestion from your sub-committee to one of the largest of these companies, that the surety companies should unite to effect a substantial change in such contract provisions, the general solicitor of this company wrote as follows:

> "As to the situation in regard to contractors' bonds possibly being cleared by surety companies refusing to give bonds on contracts in which unlimited discretion is vested in the engineer and, generally, as to the disagreeable features of bonds to the Government, I have no doubt, as you suggest, that if the surety companies would unite in a decided stand on the subject it would go a long way toward clearing the atmosphere; but the difficulty is that there are some of the surety companies so much in need of premiums that they will give any kind of a bond, for almost any kind of a premium and by so doing make trouble for the others who, while they would like to be more conservative, find trouble made for them among their own good customers by the course of action of others."

It is to be hoped that the gradually increasing number of bitter experiences of these companies will lead them to such a union and to a determination not to guarantee contractors unless the present forms of contract are corrected, substantially along the lines of your sub-committee's last report.

Your sub-committee has also been in personal conference and correspondence with G. Alexander Wright, architect, of San Francisco, the founder and secretary of the American Institute of Quantity Surveyors. This institute is endeavoring to have the English system of quantity surveys adopted in architectural and engineering contracts in this country. This represents another effort along entirely independent lines to substitute certainty for speculation in building and construction contracts. It is an interesting indication of the growing conviction that some plan must be adopted by which engineering and architectural contracting shall become less of a gamble on the part of the contractors and be placed on a sound business basis.

Your sub-committee will continue its correspondence and co-operation with the organizations and persons above named and will try to take definite forward steps whenever a practical opportunity presents itself.

Wm. B. King, *Chairman.*

A-4, Contracts Between Contractors and Manufacturers

As Chairman of Committee A-4, Contracts Between Contractors and Manufacturers, I beg to advise that I have been collecting various forms which would needed for study and consultation in preparing a model contract. When sufficient material of this nature has been gathered it is expected that the actual work of framing these contracts will then be taken up.

Respectfully submitted,

William L. Bowman, *Chairman.*

A-6 on Partnership Agreements

As Chairman of Committee A-6 on Partnership Agreements, I beg to advise that in this regard I refer you to an article "Partnership Agreements for Architects," published in the July, 1910, number of the *Brickbuilder*, and also to a practically identical arti- "Partnership Agreements for Engineers," published in the April, 1911, Cornel *Civil Engineer*. Both of these articles gave a very extended agreement, discusses each clause and suggests other clauses. My experience with that form recommends it at this time for your Society if they care to use it.

Respectfully submitted,

William L. Bowman, *Chairman.*

B-1 on Steel

Preparation of specifications of this sort from original data means years of very hard work, and inasmuch as such work has been prepared by the older organizations, such as the Society for the Testing of Materials, American Society of Civil Engineers, etc., it seemed to me hardly worth while preparing independent specifications. I think I made protest substantially of this nature at the time of the appointment.

If the Society desires to have specifications of its own, the simplest thing would be to adopt the specifications of the American Society for Testing Materials, which are the latest and most up-to-date. I must say that I am not in entire accord with these specifications in so far as reinforcing bars are concerned, particularly with regard to their including this year a specification for re-rolled bars, and I think that the 5 per cent rejections obtained by Professor Hatt in his tests of this class of material (which tests and the accompanying paper thereon formed the basis of the introduction of these specifications into the Society) are sufficient in themselves to condemn the use of this material, as these rejections are ten times as great as those we have on billet stock.

I wrote a protest for the annual meeting of the American Society for Testing Materials, and sent it down to be read, but it seems that through some clerical error the matter was not presented at the meeting, and there being no other protest, the specifications were issued for vote, which with the recommendation of the committee behind it always means acceptance. This is especially true for the further reason that in that body the members at the time they are called upon to vote have nothing before them but the original report of the committee without any of the discussion that may have taken place with regard thereto at the annual meeting, or which may have been submitted by mail.

While I might from my experience in my particular line be able to criticise the Society's specifications for my class of material, I would not presume to do so with regard to other lines. The same might be said with regard to the other members of my committee. If the committee is to be so constituted as to be able to use discriminating judgment, it must include experts in all lines, or, as is done in other societies, have sub-committees in all the different branches of steel manufacturing. I do not believe it is possible for us to get such a committee from the membership of the American Society of Engineering Contractors. If that is true, it means that we cannot lead, therefore must follow.

Under the circumstances my recommendation would be that we go over the specifications of the American Society for Testing Materials, with the idea that while perhaps a few minor changes might be introduced, the intention would be to adopt them substantially as they exist, leaving it to the more technical societies to set the pace in this line of work.

Yours very truly,

A. L. Johnson, *Chairman.*

B-5 on Standard Specifications for Lime and Cement

Your Committee B-5 on Standard Specifications for Lime and Cement, submits the following report:

A Committee of the American Society for Testing Materials has the subject of lime specifications under consideration at the present time. This committee has had the co-operation of various active members of the National Lime Manufacturers' Association of the United States Bureau of Standards, and it is believed that a specification for limes will be adopted at the approaching meeting of the Society. Your committee recommends that no action be taken in regard to specifications for lime until such time as the above mentioned committee has submitted its report.

The Standard Specifications for Cement of the American Society for Testing Materials, which require that all tests shall be made in accordance with the methods proposed by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, is recommended for consideration by the Society.

In an executive order of President Taft, dated April 30, 1912, Portland cement purchased after that date by any department, bureau, office or independent establishment of the Government, or that may be used in construction work connected with any of the aforesaid branches of the Government service, is required to conform to the specifications known as the United States Government specification for Portland cement, adopted by the Departmental Conference, February 13, 1912. This specification is also recommended for consideration by the Society.

The Government specification requires that the cement shall be tested in accordance with the standard methods described in the specification. The standard specifications of the American Society for Testing Materials include specifications for natural and Portland cement. The United States Government specification covers only Portland cement. The requirements of the two specifications in regard to Portland cement do not differ essentially one from the other.

Paragraph 1 of the American Society for Testing Materials' specifications, which covers sampling, reads as follows:

> "Cement in barrels shall be sampled through a hole made in the head, or in one of the staves midway between the heads, by means of an auger or a sampling iron similar to that used by sugar inspectors; if in bags, the sample shall be taken from surface to center. Cement in bins shall be sampled in such a manner as to represent fairly the contents of the bin. The number of samples taken shall be as directed by the engineer, who will determine whether the samples shall be tested separately or mixed.
>
> "The samples shall be passed through a sieve having twenty meshes per lineal inch, in order to break up lumps and remove foreign material."

The provisions of the Government specifiaction covering sampling are as follows:

> "SAMPLING. 16. The selection of the samples for testing will be left to the engineer. The number of packages sampled and the quantity to be taken from each package will depend on the importance of the work, the number of tests to be made, and the facilities for making them.
>
> "17. The samples should be so taken as to represent fairly the material, and, where conditions permit, at least one barrel in every fifty should be sampled. Before tests are made samples shall be passed through a sieve having twenty meshes per linear inch to remove foreign material. Samples shall be tested separately for physical qualities, but for chemical analysis mixed samples may be used. Every sample should be tested for soundness, but the number of tests for other qualities will be left to the discretion of the engineer."

The methods of testing recommended by the Special Committee on Uniform Tests of Cement of the American Society of Civil Engineers, and which are specified in the American Society for Testing Materials' specification, differ from the methods required by the Government specification principally in regard to two of the tests, viz.: the method of determining the time of setting and the normal consistency. Briefly, the American Society's method for determining the time of setting and the normal consistency involves the use of the Vicat needle apparatus, In the Government method the normal consistency is determined by the ball method and the time of setting is determined by the standardized Gillmore needles.

The standard specifications for cement of the American Society for Testing Materials are printed together with the methods of testing recommended by the Special Committee on Uniform Tests of Cement of the American Society of Civil Engineers in pamphlet form for distribution by the Society.

Circular No. 33 of the Bureau of Standards, Department of Commerce and Labor, United States Government specifications for Portland cement issued May 1, 1912, contains the Government specification and methods of testing.

Respectfully submitted,

C. W. Boynton,
Chairman.

B-7 on Stone

I herewith submit a preliminary report for the Specification Committee on Stone. It was my understanding that this specification was to deal solely with the character of the stone itself, without reference to any work or treatment it might receive in consequence of which the report is very brief.

One of the greatest difficulties encountered in the interpretation of specifications for stone in architectural specifications is the grade of cutting, many of the architects and engineers specify grades of cutting which are unknown to the trade, and which are very vague and misleading. I would suggest that specifications should be made up which would cover all the different grades of work called for in the stone trade for the various materials as follows:

Architectural Stone

All stone shall be sound and free from powder cracks, seams, checks or defects of any nature; of uniform color and texture, except that variations usually found in first-class stone work will be permitted.

General or Structural Stone

All stone shall be sound and free from powder cracks, seams, checks or defects of any nature, affecting its strength.

Respectfully submitted,

W. W. Mack,
Chairman Committee on Stone.

C-14, Harbor Improvements

As Chairman of Committee C-14, Harbor Improvements, I herewith submit my final report for the year 1913.

BREAKWATER CONSTRUCTION—In constructing rubble mound breakwaters the stone used should be paid for, preferably by the short ton of 2,000 pounds, as this is usually more satisfactory for all parties concerned than when the cuft or cuyd is used. Especially is this true where the stone is hauled direct from the quarries on scows as gauges can be placed in the scows and the load displacement quickly and accurately determined. When concrete superstructures are built, the superstructure, of course, should be paid for by the cubic yard.

As winds and rough seas are prominent factors to be considered in breakwater construction, the time for completion of a contract should be extended for a reasonable length of time before applying a penalty in cases where work has not been completed in the prescribed time, owing to unfavorable weather conditions alone, and not delayed for other causes that could have been avoided. The bonus and penalty plan, while a good thing in most kinds of construction work, cannot always be satisfactorily used in breakwater and pier construction.

While it is considered to withhold a portion of the money—usually 10 per cent—due for work done to insure the completion of the contract, it is also considered advisable to accept and pay in full for the portion of the breakwater that has been satisfactorily completed, provided a considerable portion of the remainder of the work is at least half completed. The portion to be accepted and paid for in full when completed should not be less than 25 per cent of the whole.

This acceptance and paying in full for parts of contract work that has been completed, should apply to the construction of piers and docks as well as breakwaters.

DREDGING CHANNELS, BASINS, ETC.—As it is usually difficult to determine before dredging the exact amount of each class of material, such as earth, shale, rock, etc., to be removed, it would seem advisable to determine the respective amounts at the time of dredging, instead of estimating from borings or soundings.

Very respectfully submitted,

Henry F. Alexander, *Chairman.*

D-2 on Cost Accounting

The Committee on Cost Accounting submit the following preliminary report with the view that it will bring out comments from the society at large which can be incorporated in the final report of the committee.

Owing to the diverse conditions under which the many branches of Engineering Contractors have to work, a system of cost keeping that will be applicable to all contracts must be expansible and simple in its detail.

Many systems have been under consideration, but a large number of them are more suitable for a factory than for an engineer-

ing contractor in actual contract work in the field. Some of them are so intricate and involved that the very cost of maintaining them on the job would be a considerable item to be charged against the profits and in many cases would be prohibitive.

An elaborate system of cost keeping can be utilized in a factory where there is usually a fair number of skilled workmen among the employees, and a clerical force among whom the work of collecting and tabulating the records can be apportioned; in fact one is now likely to find in a factory, men who will take pleasure in keeping up a record card. While in the field the good foreman is usually more adept with the pick than with the pencil and he sees that the work proceeds, but neglects the record.

A system that will meet with the demands of a small contractor must be one that can be applied by the man himself—his superintendent or timekeeper, and usually the man who is most adapted to look after the cost keeping is the timekeeper, who should be thoroughly capable and trustworthy; in fact, the *proper* keeping of the field notes depends largely on the personal ability of the timekeeper to consign to each employee his place on the daily record.

An important feature to be carefully provided for is the proper identification of every individual workman by some distinctive means—usually a number—and a brass check or badge is assigned to him with his number stamped upon it. Where a large number of men are employed, a badge that can be pinned on to the cap or the outside garment is very desirable, but in most instances the brass check is the favorite method employed.

His check is given to the employee in the morning and returned by him to the office at the end of his shift. This makes a check upon his presence on the job at those two times, and his attendance at the work is verified by the timekeeper at regular intervals throughout the day.

The check should be kept on board panels and which should be arranged in numerical order. The panels can be readily made to fold together and be locked up, thus keeping the records of each shift intact and separate from the other shifts.

The checks should be assigned to the workmen in groups somewhat along these lines, which of course will vary with every contract:

Office force and foreman	No. 1 to 20
Carpenters and helpers	No. 21 to 50
Machinists and helpers	No. 51 to 80
Hoisting Engineers	No. 81 to 100
Laborers	No. 201 to 400

In this way each workman can be immediately placed in his proper group as soon as his number is known.

When a number has been assigned to the workman a white cardboard check should be hung on his hook, which should be made out as per sketch:

JOHN DOE
217 Blank St.
Maryville
Laborer 20c
Started Dec. 31st
Disct.

This gives the time keeper a record that is often of value in case of accident. On many jobs workmen are only known by a number and in case of a fatal accident it is almost impossible to properly identify him. On the reverse of the cardboard check the age and name of nearest relation can be placed, and this card can be saved even though the man has been discharged, until the end of the job.

Each contractor should decide for himself to what degree of refinement he wants to keep his records, and should outline certain heads which can be further sub-divided later on. For instance, the item of plant, and its removal from the contractor's yard to the job and its return to the yard again might be put under one head (Plant) and assign a number 1. Many contractors would be satisfied to keep that expense by itself while others would want it sub-divided into, say, loading at yard, hauling to railroad and loading on cars, freight, unloading at job, and in that case would give each sub-head a number, 1a, 1b, 1c, etc. Plant erection and dismantling are often placed under No. 1, while others might prefer to have a separate item.

Temporary Buildings.
Unloading and hauling of Materials.
Excavation of Rock.
Excavation of Earth.
Building forms for Concrete.
Erecting and dismantling forms for Concrete.
Mixing and Placing Concrete.
Miscellaneous Work.

Using the above items as a start for a system of cost keeping. The daily time distribution sheet used by the timekeeper would be lined out as follows:

DAILY TIME REPORT FOR.....

No.	*Rate.*	*Time.*	*Amount.*
	.....		
	.....		
	.....		

The Workman's number in column No. 1
" " rate " " " 2
" " time " " " 3
" " amount due " " " 4

In the other columns the head spaces are left blank so that any number or item can be written in by the timekeeper, it being preferable to use a number then the record is more private than if the name of the item is used. Thus: 1 at the head of the column might with one contractor mean plant while with another it might be assigned to excavators. The workman's time is checked off under the various headings or items at which he is employed during the day. These hours must agree with his full day's record and the sum of the several columns for all the workmen must balance the time on the amount column each day.

The timekeeper's record is handed in daily and recorded in the office book, which is columned out so as to provide a column for each item, and each item column is divided into two parts, one for labor and one for material, as per sketch.

DISTRIBUTION OF CARDS.....JOB

DATE	1—PLANT		2—TEMP. BLDGS.		3—HAULINGS		4—EXCAV. EARTH		5—EXCAV. ROCK	
1914	Labor	Materials	Labor	Materials	Labor	Materials	Labor	Material	Labor	Materials
Jan. 1										
2										
3										
4										

The labor amounts are daily recorded in the book and explanations for materials are similarly recorded on the day of payment. Each column is added daily, weekly or monthly as suits the convenience, but by keeping the additions made up from day to day it is possible for the contractor to know exactly where he stands or any one on all items.

E on Scientific Management

As Chairman of the Committee on Scientific Management, I have the honor to make the following report of that committee for the calendar year 1913.

The work of the committee has consisted principally in collecting data and literature on the subject with a view to securing in convenient form as many of the facts pertaining to the subject as are at present available. The data are in the form of records of work performed and books purchased, all of which have been at the expense, and are in possession of, the chairman of your committee.

The engineer or the contractor is interested in scientific management from one of three points of views: its history, its scope, and its limitations, and it is believed that within the practicable compass of this report your committee can do no better than to treat briefly of these three elements.

I. HISTORY: Scientific management, which is a term generally applied to the application of the tools and methods of an exact science to the problem of handling men and machinery, is no less undergoing a process of evolution than it was a hundred years ago. The most that we can say in favor of our present practice is that it is a good deal ahead of where it was then. "In Principles of Political Economy," by John S. Mill, 1909 edition, page 768, there is mentioned an experiment in profit sharing which was originally described in a pamphlet published in the year 1842 by Mon. Leclaire, who employed on an average two hundred workmen, whom he paid in the usual manner, by fixed wages. To himself he assigned, in addition to the interest upon his capital, a fixed allowance for his labor and salary as manager. At the end of each year the surplus profits were divided among the body, himself included, in the proportion of their salaries. The profit sharing among his workmen did not apply to all of them, but to a certain portion, rather less than half of the entire pay roll. To all of his workmen he paid the full market rate of wages and the share of profit assigned to them was a clear addition to the ordinary compensation of their trades, the extra compensation being used as an instrument for improving the quality and quantity of the work done per man. Leclaire found that this method worked very successfully so long as he could attend to all the details himself, but as soon as his business grew to the point at which he could be nothing more than the center from which orders were issued and to whom reports came, his former troubles returned.

It would seem that before 1842 some of the advantages and disadvantages of scientific management had become apparent and the subject had commenced to receive intelligent consideration. The subject developed slowly until the announcement of a method of profit sharing, published in Transactions American Society Mechanical Engineers, Volume X, page 600, by Henry R. Towne, and a little later another method of payment described in the Transactions of the same Society, Volume XII, page 755, by F. A. Halsey. Then in 1895 Mr. Taylor read a paper before the Society of Mechanical Engineers discussing the advantages and defects of the Halsey system, after which, in 1903, there appeared his monumental paper, No. 1003 in that Society, entitled "Shop Management," to be followed three years later by another paper entitled "On the Art of Cutting Metals." There also appeared, in 1902, a "Bonus System and Reward of Labor," by H. L. Gantt, in the Transactions of American Society Mechanical Engineers, and an article in 1906 by Harrington Emerson, entitled "Shop Betterment and the Industrial Method of Profit Sharing." A very large part of all this material is based on the facts covered in Mr. Taylor's paper published in 1903. These papers of Mr. Taylor, their discussions and various rather unimportant minor contributions to the periodical press practically covered the salient developments of the subject until the publication, in 1908, of a small volume entitled "Cost Analysis Engineering," by Richard T. Dana, with an introduction by Halbert P. Gillette, and a larger volume entitled "Cost Keeping and Management Engineering," by Gillette and Dana, published in 1909. These last mentioned books were the result of an attempt to develop a science of management along the lines of a true science, codifying the known laws of the subject and laying down certain rules whereby the laws could be enforced in a practical way.

Nothing much was added to the literature of the subject for about two years, with the exception of some interesting papers and discussions in the periodical press by the followers of Taylor, but after that time the mills seemed to have commenced to grind more vigorously. Prof. John C. Duncan, in 1911, published "The Principles of Industrial Management." This is an interesting volume carefully prepared from the point of view of a professor of accountancy. In 1911 Mr. Taylor published a book entitled "The Principles of Scientific Management," which is a general discussion of the material covered in his paper of 1903.

In 1912 appeared "The Twelve Principles of Efficiency," by Harrington Emerson, which is a "popular" presentation of Mr. Emerson's idea of the subject, and in the same year there appeared dom realizes the scope of scientific management as it might be applied on his work, so does the average efficiency engineer fail to realize the limitations that should be applied to his own subject "Concrete Costs," by Taylor and Thompson, containing a large quantity of data on the detailed unit cost and time required for handling the materials of concrete.

Harking back again to 1903, Mr. H. P. Gillette prepared a little book entitled "Earth-work and Its Cost," which contains a large amount of economic data on the handling of earth and lays down a number of principles which are applicable to general scientific management as well. This book, appearing in the same year as Taylor's paper on "Shop Management," presents a number of economic discussions from the standpoint of the contractor viewed from a different point of view from that of the shop manager and containing principles which establishes for it a field of its own in the general subject of economic engineering. Another book by Mr. Gillette which covers a branch of scientific management from a broad point of view and which met with instant response from the managerial public, was "Rock Excavation, Methods and Cost," appearing in 1904, in which a number of additional principles were brought to the attention of the engineering public. The next year, in 1905, Mr. Gillette published the first edition of his "Handbook of Cost Data," of which there were some 18,000 volumes sold before it was re-written and enlarged to 1854 pages in 1910. In 1905 there was published in England "Commercial Economy in Steam and Other Thermal Power Plants," by Robert H. Smith. This book, confining itself to thermo dynamical economics, is a monumental addition to the subject of engineering economics and contains admirable mathematical discussions and analyses of the relations between the different factors of the mechanical part of the subject. "Applied Methods of Scientific Management," by F. A. Parkhurst, appearing in 1912, contains interesting tables and diagrams, with sample instruction cards, etc. "Factory Organization and Administration," by Hugo Diemer, published in 1910, gives some interesting blank forms and describes many convenient methods in shop management. Some excellent summaries are contained in "Works Management," by W. D. Ennis, published in 1911. The list of recent books is a long one. Others which may be mentioned and which are deserving of investigation by those who desire to enter thoroughly into the subject, are "Factory Manager and Accounting" (1910), by H. L. Arnold; "Cost of Manufacturers" (1907), Capt. Henry Metcalf; "Human Factor and Works Management" (1912), James Hartness; "Methods of Santa Fe" (1909), Going; "Construction of Graphical Charts" (1910), by J. B. Peddle; "Increasing Human Efficiency in Business" (1911), W. D. Scott; "Psychology and Industrial Efficiency" (1913), by Hugo Munsterberg; "Cost Keeping and Scientific Management" (1911), H. A. Evans.

A very scholarly book published in 1908 with many formulae and diagrams on the economics of thermo plants is the "Economy Factor and Steam Power Plants," by G. W. Hawkins. A large quantity of data in the civil engineering field pertaining to scientific management is contained in the "Handbook of Steam Shovel Work," published by the Bucyrus Company, being a report by the Construction Service Company on economies of steam shovel work (1911), and of the same general nature is "Rock Drilling" (1911), by Dana and Saunders. While there are other books and other technical articles on the same subject, the above list fairly comprises the contemporary literature on the subject which is known to your committee. A perusal of these books will give a very fair general idea of the subject in its development to date. Other laws of management and other rules of applying them have been collated and it is expected that they will shortly be in shape for publication.

II. SCOPE: There is hardly room within the limits of this report to discuss thoroughly the scope of scientific management in engineering and contracting, except perhaps to say that there is no real limit to it theoretically. The practical limit is the cost of the service in relation to the saving to be effected by applying scientific management to what ordinarily would not be considered a scientifically handled job. It costs something to organize, investigate, and apply the most modern methods, just as it costs something to buy the newest and most up-to-date machinery for all sorts of work, and just as the newest and most up-to-date machinery is most economical for certain jobs, so is the most up-to-date scientific management of advantage on certain jobs. The method of determining whether the cost is justified by the advantages to be gained is similar in the one case to that in the other. It pays to spend a little less on the up-to-date outfit than there is a certainty of receiving in the savings to be effected.

III. LIMITATIONS: Just as the contractor or manager sel- at some one else's expense. Besides its cost there are various difficulties that arise in the application of methods of scientific management. The trouble is that the man who is very familiar with the work to be managed is likely to fail to appreciate certain of the necessary laws of scientific management and to fall down in an amateurish effort to apply them; and the efficiency engineer in applying the laws of which he is thoroughly convinced may ignore certain of the laws of the business to which he is trying to apply them and wreck his own efforts because he does not know enough about the business of his client. It is necessary, therefore, either that the client's manager shall absorb the prin-

ciples of the science which has largely been developed outside of his own subject, or else to insist that the efficiency engineer should proceed to learn the business to which he is going to apply his own science before he takes on the work. As a partial solution to many of the difficulties involved here it is expected that a publication will soon be issued giving a large number of newly discovered laws with some of their applications and suggestions as to how their application may be made more general. Towards such an end it is hoped that this Society, through the publication of its Journal, and by the common interest of its membership, may help the engineering profession and the contracting business as a whole.

RICHARD T. DANA,
For the Committee.

F-3 on Legislation Affecting Labor

Your Committee F-3 on Legislation Affecting Labor, desires to report as follows:

Owing to lack of organization very little work has been done on the matter and this is to be regretted, as the subject is of great interest to every member of the Society, as it is doubtful if any member is not more or less affected by legislation bearing on labor.

Considering the importance of the subject and the broad field to be covered, it is suggested that a permanent committee be organized to secure data as to existing laws, the formation of proposed laws, etc., and to this end a suggested organization is drafted below.

GENERAL COMMITTEE ON LEGISLATION.	ST. LOUIS BRANCH.	States West of the Mississippi River.
	INDIANAPOLIS BRANCH.	Indiana, Ohio, Kentucky, No. Carolina, So. Carolina, Florida, Virginia, West Virginia.
	NEW YORK OFFICE.	Maine, Vermont, New Hampshire, Connecticut, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania, Maryland, Delaware.
	CHICAGO BRANCH	Illinois, Wisconsin, Michigan, Tennessee, Mississippi, Alabama, Georgia, Florida.
	EAST CANADA COMMITTEE	Ontario, Quebec, New Brunswick, Prince Edward Island, Newfoundland.
	WEST CANADA COMMITTEE.	Manitoba, Saskatchewan, Alberta, British Columbia.

The above suggested arrangement is susceptible to changes as workers may be found which would render a further sub-division of territory expedient.

The intention would be to have the work pro-rated among the live branches of the Society and where an active branch does not exist, then among a small group of the members in the same locality. The General Committee on Legislation Affecting Labor should be composed of a chariman, the secretary of the Society, the presidents or secretaries of each active branch, and the chief worker in each locality not covered by a branch.

The sub-committees should report to the local branch or local chairman and they in turn to the General Committee on Legislation Affecting Labor, who would formulate reports as would be necessary.

The General Committee would then be able to draft a suggested model law to cover any particular condition and the local organization could work to secure the enactment of such model laws or the amendment of existing laws which may be unfair to either or all parties concerned.

The reporting of suggested laws whether fair or unfair, to our Journal, and the publishing of such items as news might be productive of much good.

We should also, through the General Committee on Legislation Affecting Labor, work with any other body or bodies, such as builders' exchanges, manufacturers' associations, etc., so that our combined efforts would be more productive of good than our own individual work.

In considering the above suggestions it should be borne in mind that legislation may be carried by the Federal or Dominion Governments, State or Provincial Legislatures, and by municipal councils.

Some of the points that have been or may be controlled or effected by legislation are as follows:

Workmen's compensation for injuries,
Time and method of paying wages,
Hours of work,
Minimum rates of pay,
Specified methods of doing work to prevent accidents,
Compulsory insurance for either employer or employee or both.

Many municipal councils have been and are being worked upon by labor unions for the purpose of establishing minimum rates of pay, for certain working hours, etc., for unionization of workers by compulsion by having clauses inserted in public contracts, compelling the contractor to employ none but union men.

The Provinces of Alberta and Saskatchewan have what are called "Workmen's Compensation Acts," whereby an injured employee may bring suit against his employer for injuries sustained while in his employ and certain maximum amounts are set forth as damages, in the acts.

There is sufficient difference in the acts of the two provinces to cause a difference in premium rate amounting to 50 per cent, the 50 per cent higher rate being charged in the Province of Saskatchewan, on one class of labor.

This illustration is sufficient to show that something is wrong with one of the two acts and if any part of one or both acts is unfair then they should be amended, but such amendment can be secured only by combined action of all parties concerned, after they are armed with facts and figures bearing on the same question in other parts of the country.

There is a continued tendency to legislate in favor of the employee and against the employer and while the time has arrived when some compensation should be made to injured employes, yet the causes of accidents, and the conditions bearing on same must be taken into consideration and a premium should not be placed on carelessness.

As the Saskatchewan act now stands, farmers are exempt from the act, all other employers are covered and even if an employee should deliberately thrust an arm into a gear or under a shear, he can secure compensation under the present act, in an amount not to exceed $2,000.

The employee may enter suit either under the act or under the general law but after having received a verdict under one, he cannot again bring action under the other and he must elect under which law he desires to prosecute his claim.

No jury passes on the questions under the act but the evidence is considered by a judge and his decision is based on the facts brought forth and such facts or evidence causes the judge to decide on the amount of the damages and not on the question as to whether the plaintiff was negligent in the performance of his duties.

There is now before the Saskatchewan Parliament an act to regulate the time of payments, etc., and it states that weekly paydays must be enforced, and that payments shall be made in either coin, currency, or certified checks.

These few examples will tend to show the necesstiy of having this committee organized on a broader basis to the end that work of value can be reported.

W. R. HARRIS,
Chairman

ABOUT ARBITRATION AND COMMITTEE WORK

DISCUSSION—Afternoon Session—Annual Meeting

MR. H. J. COLE: With reference to the subject of arbitration, there is room for considerable improvement in the present methods, where each party to an agreement selects an abitor, these two select a third, it is almost certain that there will be a deadlock sooner or later unless the third party is absolutely disinterested and honest. If instead of this arrangement three men of standing or prominence should be selected, it would be far better. Of these three men one might be a judge, the other a city engineer and the third a street commissioner or a business man previous'y specified in the agreement. The contract should also specify the payment to be received by these arbitors, so that these gentlemen would receive ample remuneration for the time and labor expended in settling the dispute.

MR. F. A. SNYDER: In England they seem to have a better method of arbitration than any we have used here. In the discussion on the Rotherhithe Tunnel by E. H. Tabor, published in Volume CLXXV., p. 28, of the Proceedings of the Institution of Civil Engineers, Mr. Wm. R. Galbreith tells about a dispute between the contractor and the engineer on the Charing Cross and Hempstead Line that was settled by Sir Benjamin Baker in a day, Sir Benjamin Baker acting as arbitrator.

I have written to England in relation to this method of arbitration and as soon as I receive a reply will advise this Society.

MR. WM. B. KING: When the subject of international arbitration was taken up at The Hague, no provision was made for the appoint-

ment of permanent arbitrators. This was an oversight which was very soon realized and at the next Hague Conference a permanent Board was selected. When any questions arise between nations, they can select from a list of permanent arbitrators.

This is in a general way the course which should be followed by us in advocating arbitration agreements. Some sort of permanent arbitral tribunal should be constituted. The prominent engineering or contracting Societies ought to name a number of permanent persons from whom arbitrators could be selected. This tribunal may be local or general. The British system provides usually that arbitrators are selected by the presidents of the large engineering societies.

Mr. H. J. Cole: Mr. King's suggestion is practical and feasible. The great advantage is speed, which is very necessary in the execution of contracts. In all cases a prompt decision is wanted. Or as has been suggested by Mr. King, the National Societies might name a certain number of their members to form a Board of Arbitration from which could be allotted, where occasion arose, three or more to sit as a tribunal on the matters in dispute; choosing for each dispute men experienced along the particular matters in question. This method would tend to magnify the importance of the Societies and produce better results in the arbitration.

On the subject of committees as stated previously, the work of the committees usually has to be done by the chairman, because almost invariably he finds it quite impossible to get in touch with the other members of the same committee. Either they do not answer communications or else they do no work at all even though they agree to do so. It is very hard to get any suggestions from members of committees, and as a result the chairman is usually obliged to do all the work. In 1912 the society started out to follow Major Gillette's idea that a law should be prepared to control the award and execution of public contracts. The matter was referred to a committee, and in this case the society was fortunate in having members appointed to that committee, who actually did a good deal of work and secured splendid results. As you all know their report was submitted in the shape of a proposed act, and was published in the Journal of the society. I would suggest that at the next session of the New York Legislature, this law or some modification thereof should be presented. In 1914 it will be the aim of the society to continue along the line of establishing a set of standard specifications. It will take time and the co-operation of many men to do the work. If every member of the society would chip in and help, something could be accomplished in a short time. As regards specifications for materials, I believe that the best ones already adopted by such societies as the American Society for Testing Materials should be likewise adopted by this society. That would enable us to concentrate on other items that have not been standardized and probably secure better results. There is one thing certain, that is, we should bring something or other to a head during each year, and keep pressing forward toward the completion of this line of work. All members are urged to study the list of committees and suggest changes or improvements to the Secretary, and at the same time state what work they are willing to assist in.

Mr. F. A. Snyder: In my opinion the Board of Direction should have authority, in case a chairman or other member of a committee does not show any inclination to do any committee work, that another member can be appointed.

Mr. T. Hugh Boorman: My suggestion is that the Technical Standards Committee could not do better than to advocate the adoption of standards already adopted by the American Society of Testing Materials for Steel, the National Concrete Institute, the Joint Specifications of the American Society of Civil Engineers and the American Society for Testing Materials for Portland Cement. We should give our approval to such specifications if we do not see any possibility for improving thereon. These people have spent much time and thought on the subject and it would do us credit to approve such standards as were adopted by them.

Mr. H. J. Cole: If the consensus of opinion of the members of the Society is in favor of the foregoing, many committees can be eliminated and the work greatly simplified. I would, therefore, be in favor of a movement of this kind.

Mr. Wm. B. King: As regards committee work, the most essential thing in my opinion is to have the work done efficiently. If we have many committees and sub-committees, we arouse wider extended interest, and it is worth while to follow this plan to keep up the work. It is generally advisable, and perhaps it may always be advantageous, to have only one member of a sub-committee. As a matter of fact, the work is usually done better by one man. It is better than a large committee, and the work is done more rapidly. Make one man responsible, and we shall get good results such as were shown this afternoon, I should not be in favor of a change in the present scheme which I think is well organized.

Mr. H. C. Lyons: Mr. King's remarks are very interesting to me. I have been appalled by the magnitude of the subject that was referred to me as chairman of committee C-15. Some committees should be split into smaller sub-divisions. It is probably true of many committees, that their work, like mine, was of too great magnitude to be treated within a short time. Under those conditions, we should not expect very rapid progress. I believe that the chairman of each committee should be empowered to recommend whatever specifications on his particular subject should be adopted.

Mr. Edward Wegmann: I am pleased to endorse the attitude taken by previous speakers and I likewise have found that the trouble with the committee work is in many cases the magnitude of the subject assigned. The board should be authorized to make changes and to simplify the work. I am also in favor of the adoption of standard specifications already advocated, or approved by other societies. I also recommend and ask that each member of the society make it his own business to send in information to the committee which had to deal with the subject he is particularly interested. Let all the members of the society help along this work, and the results will be astonishing.

Election of Officers and Directors

REPORT OF TELLERS

For President.....Edward Wegmann
For First Vice-President.....H. F. Hackedorn
For Second Vice-President.....J. H. Tromanhauser
For Directors..Wm. L. Bowman, Howard Egleston, H. F. Pomeroy

Amendment to the Constitution, Article VIII., Section 1, was adopted, as follows:

Strike out the word and numeral "two" (2) and insert the word "one" in both instances.

Change the word "lists" from the plural to the singular in both instances.

The amended clause now reads:

"At least 60 days before each Annual Meeting, the Board of Directors, which shall sit as a Nominating Committee, shall nominate to the Society one (1) list of officers for the next ensuing year, and one (1) list of three Directors to serve for three years."

Presidential Address

SYNOPSIS

Mr. Wegmann, our new President, made a short address, reviewing the history of our Society and pointing out its great field of usefulness. He said that formerly engineers and contractors were apt to regard each other as enemies, but this is no longer true.

The American Society of Engineering Contractors provides a place where public officials and engineers can meet the contractors on a social footing and discuss with them questions of mutual interest.

Mr. Wegmann stated that the examination of the books of the Society by expert accountants showed a steady improvement in the finances of the Society. In conclusion he urged the members to work with new enthusiasm to make the American Society of Engineering Contractors a great success.

There's a Reason

There are many reasons for the delay in getting out the January issue. The annual meeting was held on the 16th of the month. This left us a very short time in which to assimilate and arrange the different matters to be contained therein.

As this issue is a report of the Annual Meeting, we could not begin working upon same until the discussions which took place had been revised by the various members who took part in the controversy. The revised discussions were not received in many instances until the end of the second week in February.

Hereafter, the publication of this Society, The Engineering Contractor, will be issued on a regular date each month, and shall contain news of timely interest pretaining to the field covered by this Society.

SOCIETY AFFAIRS

THE ANNUAL MEETING

The annual meeting of this society, held in New York on January 16, proved a very interesting and entertaining function.

The afternoon session was devoted principally to business. The reports of the secretary and the treasurer were read, commented upon and approved. The various committee reports submitted caused a discussion which proved beneficial, in that, members present made valuable suggestions regarding the management and promulgation of the committee work to be accomplished. The report of the tellers was received and those newly elected to office were accorded hearty applause and sincere congratulations.

The evening session was opened with an address by our new president, Edward Wegmann, after which motion pictures depicting road construction and development throughout the country were shown by G. H. Perkins, of Warren Brothers Company, Boston, Mass., who gave an explanatory talk as the pictures were thrown upon the screen. Advantage was taken of the fact that the motion picture machine was at hand to show a couple of lively and funny films, which created a good deal of amusement and added to the general good feeling. To clinch the success of the meeting those present partook of a little tasty grub with the accompaniment of plenty of smoke, after which everybody retired at 11 o'clock p. m. to partake of the sleep of the just.

Membership

Since January 1st the society has acquired thirty-five new members. This excellent showing is greatly due to the persistence of the new chairman of the Membership Committee, Mr. T. Hugh Boorman.

He has set a record which proves his ability as a hustler, having secured since the first of the month eighteen new members, and every application considered by the Membership Committee and the Board of Direction was passed upon as desirable.

Now, let the rest of us unite in a combined and enthusiastic campaign for new members. You undoubtedly have many acquaintances who would be pleased to join the ranks, had they a fair knowledge of the field covered by this organization, and its usefulness and value to them in their profession.

This society stands for a good many things, and the 1914 plan of action for the promulgation and furtherance of the work we have shouldered is very broad and progressive. The ball has started rolling, keep it going—get some society vim into your system and help to boost. If you are actually too busy to approach anyone with an application for membership, just write us a list of men whom you think would show some active interest in society affairs and the secretary will give the matter his personal attention. Join the hustlers and lend a hand by writing the secretary a postal NOW for application blanks and literature.

Answer this appeal, and help your own interests, by helping the society.

The following were elected to membership since January 1, 1914:

The Following Were Elected to Membership Since January 1st, 1914

William I. Bishop,
Commissioner,
Quebec Streams Commission,
Montreal, Canada.

Kitchell M. Boorman,
Contractors Engineer,
New York.

T. Hugh Boorman,
Consulting Engineer,
New York.

*William K. Bonfield,
Swiss Rock Asphalt,
New York.

Charles E. Bregenzer,
Editorial Department,
Sweets Catalogue,
New York.

*Wilkie James Browne,
Ahearn & Browne, Contractors Supplies,
New York.

Clarence L. Covington,
Boston Manager,
Norcross Bros. Co.,
Boston, Mass.

Hans A. Daae,
Contracting Engineer,
Sacremento, Cal.

Asbury M. Dickens,
Superintendent Asphalt Plants,
New York.

*Jos. R. Draney,
Sales Manager,
U. S. Asphalt Refining Co.,
New York.

James Sidney Ervin,
Sales Agent,
United Asphalt Refining Co.,
Gibsonburg, Ohio

Harold W. Haines, C. E.,
Treasurer,
Impervious Products Co.,
New York.

James Waite Howard,
Consulting Engineer,
New York.

Ralph Rice Hoyt,
Vice-President,
Standard Bitulithic Co.,
Newark, N. J.

James Kelly,
Cement and Asphalt,
Contractor,
Philadelphia, Pa.

Adam B. Kraft,
Contractor,
York, Pa.

Oliver O. Lefebvre,
Chief Engineer,
Quebec Streams Commission,
Montreal, Can.

Chas. C. Mason,
Advertising Agent,
The Engineering Contractor,
New York.

Chas. J. Michaud,
General Contractor,
Kingston, N. Y.

*Edward M. Oxley,
Manager,
National Transit Line,
New York.

*Arthur H. Putman,
Washington, D. C.

†David R. Reitman,
Assistant to Supt. of Maintenance,
Milwaukee Elec. Ry. & Lt.,
Milwaukee, Wis.

†Chas. G. Robertson,
Secretary,
Wemlinger Steel Piling Co.,
New York.

David E. Sayre,
Salesman,
Otis Elevator Co.,

Francis F. Schellenberg,
Constructing Engineer,
Pittsburgh, Pa.

*Dr. R. B. Schweibs,
Traveling Representative,
German Companies,
Calgary, Can.

Ralph L. Shainwald, Jr., M. A.,
Manager,
Impervite Cement, Waterproofing Dept.
Standard Paint Co.,
New York.

Richard W. Turner,
District Manager,
Warren Bros. Co.,
Newark, N. J.

G. S. Van Westrum,
Vice-President,
Westrumite Asphalt & Paving Co., Ltd.,
Winnepeg, Can.

Frank N. Wilcox,
Manager,
Hall Concrete Products Co., Inc.,
Grassland, Pa.

Clarence F. Williams,
General Manager,
Sweets Catalogue,
Ridgewood, N. J.

John R. Wilson,
Special Engineer,
Marion Company,
Washington, Pa.

G. Alexanddr Wright,
Architect,
San Francisco, Cal.

Leslie L. Wright,
President,
L. L. Wright R. W. S. Co.,
Brooklyn, N. Y.

John A. Yates, C. E.
President,
Insulatine Co.,
New York.

* Associate members.
† Junior member.

BRANCHES

Chicago

There will be a meeting of the Chicago Branch in connection with the Cement Show at the Coliseum, and with the assistance of the able members representing the society there, and working in our interests, exceptional developments are sure to follow.

St. Louis

The other day we received a letter from our St. Louis secretary, and in it were enclosed seven applications. "Nuff sed."

Philadelphia

Steps are being taken to organize a live branch in the Quaker City. Many members there are anxious to have a meeting place of their own where matters of importance can be discussed at regular meetings, thereby eliminating the necessity of many trips to the Society Headquarters in New York. Excellent results are expected to follow the energetic campaign that has been inaugurated to advise the Philadelphia engineers and contractors of our plan.

Boston and New Orleans

Society "boosters" in Boston and New Orleans are pushing to acquire enough new members that they too may get in line for organization papers and to establish a branch worthy of their respective cities.

Why Not Start Something in Your Own City?

With the sprouting up of the new branches in these cities, it is hoped that many of you who have no representative branch will desire to bring things to a head.

Much benefit is derived by out of town members through having the convenience of a representative branch where talks, discussions, conventions, dinners, etc., can be arranged to suit the local residents. Papers can be read and discussed at regular meetings and matters of local interest can be taken up for proper consideration and action.

Conditions existing in many of our leading civic centers, in regard to present laws covering the many phases of the engineering and contracting business and profession are very poor and need re-drafting. Such laws have a direct influence upon your business and if members in the various centres will band themselves together and organize a branch of the society, active steps can be taken to eliminate many of the unpleasant and unequitable provisions to which we must at present submit.

The object of this society is the advancement of Engineering and Contracting knowledge, the maintenance of a high professional and business standard, and *the elmination of certain improper practices in the profession and business,* and the promotion and strengthening of proper professional and business relations.

We have a broad field to cover and it is only with the assistance of many co-operative units or branches that we can anticipate reaching the desired goal and effecting lasting aud beneficial changes.

Write to the Secretary for further particulars.

ENGINEERING LAW

The Law of Engineering Contracts

By WM. B. KING *
Attorney at Law, Washington, D. C.

The directors of the association have been considering the question of adding to this journal a Department of Law, to occupy a page in each issue, or as much space as interest seems to warrant. This would consist of notes on recent decisions of the courts relating to engineering cases and of answers to questions which would be submitted by members of the association. These answers would not be intended to take the place of opinions in particular cases, which members would have to obtain from their own attorneys, but would be intended as a general guide to the current questions of law which arise in the active life of every engineering contractor.

Members of the association are asked to write to the seceretary and give him their views as to the value of such a department or as to the lines upon which it ought to be conducted.

It is the purpose of the directors to make the journal as useful as possible and they feel that they can be greatly assisted in this purpose by suggestions from members of the society.

ANSWERS BY WM. L. BOWMAN, C. E. *
Attorney at Law, New York

QUESTION. In connection with one of our large construction jobs, we had to have for over a year a regular supply of soft coal. To do the work properly it required a low volatile and low ash coal and when I wrote asking quotations I so specified. In reply the company offered me their "Greensboro" coal mined in a certain place. In reply I again stated that the coal must be as stated They answered that I must sign their usual form of yearly contract if I wanted their coal at the price named. I signed the contract which provided that they were to furnish me their coal, naming it and where it was mined in the specified quantities, etc., the price I was to pay and if I failed to take the coal they could sell at the best price and charge to my account the loss. Nothing was stated for, nor had they ever actually told me that there product was such, except as might be inferred by their offering the coal. After a couple months' supply had been furnished we found that it was not a low volatile coal and also not low ash. The coal would not properly do the work required of it. Upon complaint the company told me I had bought their coal and as I was getting it the analysis had nothing to do with it, the coal being merchantable. Was not our requirement and statement of the kind of product that we needed a part of the contract? Can we safely refuse to take the balance of the contract supply?

ANSWER. Upon your statement that a formal contract was signed after the letters mentioning the matter of low volatile and ash and that said contract did not mention those requirements but simply a coal named to come from a certain place, then such a requirement of a low volatile and low ash coal is no part of the contract. All talks, understandings, agreements, letters, etc., are supposed to be merged in the formal contract and being prior to such contract are not part of it nor admissible as evidence in a court of law. However, you seem to have a good chance to refuse to take the balance of the coal on the ground of fraud or misrepresentation which induced you to enter into such a contract. This is what is termed an equitable rescission. You should take special legal advice, however, before proceeding to refuse the coal.

QUESTION. I have the usual contract of employment of a planning and construction engineer for a large operation. Not being an expert in a certain line without the knowledge of my employer, I made a arrangement with other engineers to prepare certain plans and specifications with the understanding that if they got the work so planned they were not to charge me anything for such plans, etc. Later they did get the construction work, being the only bidders. My employer has not had to pay anything more nor lost anything by the arrangement, but now that he has learned of the arrangement, he refuses to pay me for my services. Never having heard of any such refusal so based will you let me know if it amounts to anything legally.

ANSWER. Yes, you have committed a serious legal breach of your contract of employment in secretly entering such an arrangement as suggested. There is at least one reported case much similar, being the case of an architect, and it was there held that the architect could not recover either for the furnishing of the building plans and specifications nor for superintendence. Personally I believe this case too drastic and that it would not ordinarily be followed to the full extent. The rule, however, is that when you are employed and paid by one man you must not do anything without his knowledge, which might appear to affect your judgment in the matter or your advice as regards bids and bidders. Nor must any secret pay nor commissions be taken from anyone connected with any of the work.

* Member of the Society.

ACCOUNTING DEPARTMENT

Conducted by HARRY M. SMITH,* *Certified Public Accountant, New York*

With this issue of the Journal, a new department is inaugurated. It is our intention to make it of value to members interested in accounting matters and it is hoped that the progressive spirit now pervading the affairs of the society will aid in making it a success.

It must be appreciated, however, that the enthusiasm of a few members in this or any other of the society's activities cannot produce the desired results; there should be hearty co-operation on the part of all concerned in order that the maximum benefits may be realized.

In these days, keen competition is stimulating executives to obtain fairly accurate costs. There has arisen a demand for improved methods of accounting in all its branches. As a class, you are interested in obtaining accurate accounting methods in your own offices. Therefore, it is not assuming too much to expect you to respond heartily and send in for discussion, an outline of some of the points that have proven puzzling in the operation of your accounting departments.

It is proposed not only to discuss such points as are submitted by members but also to outline briefly, simple but comprehensive methods of office routine and accounting; the various rulings of books of account such as ledger, cash, journal, voucher record, pay roll, etc., which will be given with suggestions for their proper use.

It is also proposed to set up statements of the accounts, including the form of Balance Sheet, and of Profit and Loss Account, in the shape preferred by financial interests. Such forms should be of value to those who are accustomed to furnish statements as a basis for credit at their own banks or for the sale of their notes in the open market.

It is customary for accountants to furnish with such statements certain percentages of costs which in line with an actual system of cost accounts are of value to the management. It is obvious, however, that percentage of costs prepared from financial statements even if averaged over a term of years are not dependable in engineering work, because of the widely varying conditions that are encountered in the field.

The fact remains that in any business much valuable information may be obtained from a study of its history as indicated by the accounts, provided that results are properly tabulated comparatively, with complete schedules of percentages previously referred to.

It is not our idea for the present to engage in a discussion of costs, inasmuch as this society is already actively engaged through its proper committees in that particular branch of accounting or engineering, whichever it may be regarded. As the department progresses, though, there should be complete co-operation along these lines with the aforesaid committees.

Now as to the points submitted for discussion. Those taken up must necessarily be such as appear to be of general interest. Before the next issue appears, certain data will no doubt be available that will enable us to proceed.

* Member of the Society

EMPLOYMENT BUREAU

Actuated by a desire to be of direct assistance to all of its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

Men Available

003 Junior member of this Society, twenty-three years old, single. Education at Stevens' Institute of Technology, Mechanical and Electrical Engineering. Present position as chief operator in substation of an electric railway and light company. Has been employed with three large corporations in the following capacities: Assistant to engineer of tests, start and run tests on boilers, turbines, generators, engines, pumps, etc. Responsible for results. Inspection and analysis of efficiency; able to operate switchboard, put in turbines, etc. Cadet engineer, laying gas mains, erecting pole lines, keeping records of meters, transformers, lamps, etc. Generator tender and switchboard operator. Record A-1.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

Quantity Surveying

In the future the society will take up the matter of Quantity Surveying for careful consideration through a special committee which has been created, with Mr. G. Alexander Wright (member) as chairman.

Mr. Wright is a member of the San Francisco chapter of the American Institute of Architects, the California Academy of Sciences, the Technical Society of the Pacific Coast, and an honorary member of the Quantity Surveyors' Association, London, England. He is also author of "Wright on Quantities" and "Building Arbitration."

The labor is a self-imposed one, the movement being started by Mr. Wright in 1891, and nobody is being paid for it. He has travelled 11,000 miles lecturing on the subject, and is visiting twenty-eight of the largest cities from the Atlantic to the Pacific coasts.

According to Mr. Wright, the quantity system is the only one that gives the contractor a square deal, and eliminates the waste of millions of dollars in the estimates of the cost of buildings and construction work. It not only betters the system of estimating, but it reduces to a certainty, eliminating all guess work, the cost and quantity of material used in the work.

Mr. Wright believes the qauntity system to be the only scientific and accurate method to estimate to a certainty in so far as the amount of material is concerned.

While the United States has made rapid progress in the last fifty years it is far behind the times in this particular direction. And the methods followed have come down from the early colonial times.

Something About Advertising

The failure of a trial advertisement has set more business men against advertising than any other factor in publicity. This is a pity when the indefiniteness of a trial advertisement is considered. A trial advertisement represents low-water mark—absolute bottom.—It is not decisive. It has no more value as evidence than a first meeting with an individual who afterwards becomes your friend. Of all the advertisements in a long compaign, the first ad is the worst, though it is written by an adept. If it is written by a novice in advertising, that novice will never write a weaker one. It is like the first discord struck out of the piano by a beginner. If a student becomes disgusted with such an initial effort he will never get farther, and if a merchant abandons his advertising intentions because the first advertisement was unremunerative, he will never get farther. The first attempt at anything is valuable only as an educator. Advertising is like seed sown, it's got to have time to grow before you can reap the harvest.

If a paper, after careful examination, impresses you at all favorably, it's worth giving a fair trial. In no case should a trial ad be inserted for less than six months. If the paper is going to be a paying investment for you, it will begin to show results by that time.

There is a big difference between feeding a cow just enough to keep her alive, and feeding her enough to create a profit.

The same is true about advertising. Nine times out of ten a small advertisement inserted one or two times is simply a waste of money, while the same advertisement inserted for six or more months would have become a paying investment.—*The Architect and Engineer.*

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY
OF ENGINEERING CONTRACTORS, INC.

AM. SOC. ENGINEERING CONTRACTORS 1909

Volume II—No. 2
NEW SERIES
FEBRUARY, 1914

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Published Monthly by the *American Society of Engineering Contractors, Inc.*, 11 Broadway, New York City, N. Y.

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Entered as Second-Class Matter April 16, 1912, at the Post Office at New York, N. Y., Under Act of March, 3, 1879

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HARRY M. SMITH*
Certified Public Accountant
New York Philadelphia
*Asso. Member of the Society

At a meeting of the Board of Direction of the American Society of Engineering Contractors, Inc., it was voted, that *The Engineering Contractor*, shall be the official means of communication with members of the Society and that all notices heretofore sent out in circular form will be inserted therein, and shall be considered as legal notification, except in case of emergencies.

SURVEYING INSTRUMENTS

Owned by State Board of Education of New York

Used by GEORGE WASHINGTON In the Building of Roads

Copy of pen-written statement pasted inside of cover of an instrument box

"The instruments contained in this box, together with a case of protracting instruments in a shagreen case, two surveyors' chains and the wooden pins used with the same, were the property of General Washington, and used by him when a very young man.

"These instruments descended to my father, Colonel William A. Washington (the General's oldest nephew), and from him to me, and by me presented to my son, Lewis W. Washington, Febry. 10th, 1854.

(Signed)
G. C. WASHINGTON."
Georgetown, D. C.
Feby. 10, 1854.

Box of Surveying Instruments

This oaken box, fourteen and a half inches long by seven and a half inches wide and four inches deep, contained, besides a compass, various instruments, all of brass, such as a scale of parts, parallel ruler, spirit-level, etc. Washington commenced his studies in surveying when he was fourteen years of age, as appears from a ms. volume of his "Book or Surveys, 1746," now at the Cornell University. Lord Fairfax appointed him surveyor for his own lands, with a compensation of three dollars and fifty cents a day, when he had just entered his sixteenth year, and he became public surveyor of the province, after two years' service with Lord Fairfax, for the three following years.

Pocket Protecting Instruments

A case of mathematical instruments covered with shagreen, with silver hinge and hasp, the same in form as is still sold for students.

Surveyor's Compass

This compasss, which was contained in the box above mentioned, has engraved on its face, "D. Rittenhouse, Philadelphia." Its maker, David Rittenhouse, was the distinguished astronomer, who became President of the American Philosophical Society, and was a Commissioner to define the boundary between Pennsylvania, New Jersey and New York in 1769-70. He was born in the same year as Washington, and was engaged in the manufacture of mathematical instruments and clocks at as early a period as the former commenced surveying. It is impossible to say whether this compass was manufactured by him before he opened an establishment in Philadelphia in 1770, as there is no date upon it. His first shop was opened in city, in 1751.

Surveyor's Tripod

This is made of oak, mounted with brass. The three legs are each in two sections, with brass screws to unite them, for the purpose of easy transportation on horseback. In the original inventory it was described as "Jacob's staff."

Measuring iron chains, the large sized one, 33 feet 2 inches long; the small size, 30 feet long. This is the first used by him, and probably some of the links have rusted off. Also, six wooden marking pins, of ash.

A LETTER FROM THE LATE A. S. DRAPER, COMMISSIONER OF EDUCATION, STATE OF NEW YORK

Albany, December 5, 1910.

MR. T. HUGH BOORMAN,
Highway Engineer,
Claypool House,
Indianapolis, Indiana.

Dear Sir:

In reply to your letter of December 2, I have pleasure in advising you that the surveying instruments of Washington, in the custody of this Department, were photographed by our Visual Instruction Division on Saturday last, and both a photograph and a slide will be forwarded to you to-day at the address given. The photograph shows all of the surveying instruments of Washington that are in the possession of this Department. You may keep the photograph, but I will ask that you return the slide when you are through with it.

I enclose herewith copy of a pen-written statement which is pasted on the inside of the lid of the box containing some of the instruments. Also, I inclose copy of extracts taken from the 56th annual report of the State Library, for the year 1873, concerning these relics.

There will be no charge to you in connection with the photographing of these instruments. There had never been any pictures taken of them and it was difficult to see our way to doing the work just now; but we are glad to have the negatives in the collection of our Visual Instruction Division.

Very sincerely yours,
A. S. DRAPER,
Commissioner of Education.

Give due credit to the New York State Education Dept.
A. S. D.

THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, FEBRUARY, 1914 Number 2

A Letter from P.U. BLIC to C.O.N. TRACTOR

THANK YOU for the copy of the January issue of the Engineering Contractor. It certainly proved interesting to me, especially that article about "Something for Contractors to Think About." I am sure that you must have concluded that it is up to you to do something to clean up the whole business.

¶ As a class you have shown that you are game. You can lose as cheerfully as the best sport and you do not lose your nerve in cases where the average strong arm gent would have a conniption fit. At the same time you need a greater combination of human and practical knowledge of things than any other business man needs. Yet, why this lack of spunk when it comes to handing over the "mazuma to the delegate from 'headquarters.'"

¶ I must confess that I don't see where your backbone is, or is it that you don't care because if you are held up you get the "contribution" out of the job for which I have to pay.

¶ Well, no matter how you figure it out, you certainly look inexpensive when some inquisitive attorney or investigator decides to find out where the money paid for public work has gone.

¶ Now it is New York State that is being put to shame, again it is Pennsylvania, before that it was some other state, and so on. No matter where you are located, whether in Seattle or in Key West, the same thing is going on, and it seems to me that you all must share the responsibility and the odium.

¶ Why let it go on, when you have the power to wipe out the whole disgraceful bunch of leeches who feast on the result of their give-me-a-percentage-of-your-contract system of extortion? It's beyond me, I am abashed, flabbergasted, frazzled.

¶ The trouble as I see it, is that you do not support and boost your organization as you should. United, your power for good would be irresistible. If you once and for all time refused to pay graft, politics would be clean. No crook would long remain in the public service (?) except for graft. Your responsibility is great.

¶ Don't think all you have to do is to sit down and nod your head and exclaim and declaim: "By jove P.U. Blic you are right!" But while you're sitting, write to each one of your friends in the business of engineering and contracting. Tell him that you are a member of the A.S.E.C., and what a good thing it is; that he, being an honest man, owes it to himself to come in, and when you are through, simply hold him up, and demand his application. If you believe in him, I am sure he will be accepted; he don't need any degree although that's a good thing.

¶ Don't let George do it, but live up to the specifications yourself, now, to-day, to-morrow, and then some.

As DAVID GIBSON of Cleveland, says: "*Watch what the other fellow is going to do and we don't do anything ourselves.*"

Construction Features—Asphalt Block Pavement

NEWBURGH, N. Y.

By JAMES L. KEHOE*

An important street was recently paved in Newburgh, N. Y., being the first asphalt block street in the city. The street extends from Broadway to the city line, and is one of the main approaches to State Route No. 3.

The contract was awarded in two sections to Jova & Kehoe, Inc., general contractors, Newburgh, N. Y., and the writer was in personal charge of the work. The total length of the street is 6,000 feet, and width 40 feet. On Section 1 the excavation consisted of old macadam, and Section 2 gravel and hardpan with trolley tracks in the center of of the street.

The total contract price was $74,279.72, which included the following items: 25,000 square yards of excavation, concrete foundation and two-inch asphalt block, 11,912 feet concrete curb with protected corner bar, 3,107 cubic yards extra excavation and thirty-five inlet basins, manholes and catch basins.

Concrete Curb

The curb was 6 inches wide at the top, 8 inches wide at the bottom and 24 inches deep, laid on a 6x12-inch cinder foundation. Wainwright steel corner bar was used with expansion joints every 10 feet.

The method of placing curb was to start a gang of men on each side of the street removing old curb flagstones and excavating to grade. Two men followed and placed forms in position from grade stakes set 2 feet back from curb line. Hotchkiss steel metal forms were used consisting of steel side rails 10 feet long, 6 inches wide with slots at 1 foot intervals to receive division plates, steel templates and wedge shaped keys to fasten parts together. The rails were joined by a tongue and socket.

Supply piles of cement, sand stone were made every 200 hundred feet with enough material to place four hundred feet of curb. The concrete mixed middling stiff in a low charging Standard gasoline mixer was wheeled in barrows to forms. Immediately after concrete was placed two men started leveling and tamping, keeping the concrete back one inch from face and top. Following this the face mixture was placed. This was mixed quite stiff with just enough water so that when tamped into forms there was moisture enough to face and top the finish nicely. Two men began striking off, then finishers started floating and edging top without waiting for a puddled surface to dry out.

After one hour setting forms were taken down (knocking keys out of templates), side rails removed, templates drawn through and face of curb floated and finished. These forms were cleaned, oiled and moved ahead. At least 50 feet of forms on each side of street were always ready before the pouring of concrete started. Water for mixer was from a 1-inch pipe line laid by contractors along sidewalk with a 3-4 inch tee every 100 feet, connections being made from the hydrants. The same method of placing curb was used in Section 2, excepting that one entire side was finished at a time; 200 feet of finished curb was averaged per day by a gang consisting of one foreman, two finishers and ten laborers.

Earth Excavations

Owing to the short time allowed to complete the work, together with the hard cutting, it was deemed advisable to use a steam shovel. On Section 1 a Thew shovel of the traction type was placed in the center of the street loading from both sides into 1 1-2 and 2-yard dump wagons. Cuts averaged from 12 to 18 inches deep at the center line and 4 to 6 inches at the curb. Material consisted of old macadam. A level cut to grade was made by the shovel across the street for a width of 25 feet and the material near the curb was piled in front of shovel by means of buck scrapers.

This work was always done after quitting time or before starting in the morning. In this way the shovel always had enough material to load all teams for the first trip without loss of time. Owing to the shallow cutting the shovel was moved up about every five feet, and when there were no teams to load the shovel kept crowding ahead, piling material. The average loading time for a 1 1-2 yard wagon was one minute. Fifteen teams averaged 250 cubic yards per day.

On Section 2 the material consisted of hardpan and gravel. The shovel was placed between trolley tracks and curb, loading across the tracks into side dumping trolley cars and dump wagons. Owing to the boom on the shovel having only a few inches clearance from trolley feed wire, two extra men were employed to raise and lower the wire, using notched poles. As the traction company maintained a twenty-five minute schedule some time was lost by the shovel on account of the wire being raised and lowered so often. The earth between the tracks was ploughed with a heavy rooter plough hauled by a trolley car, with the shoe on the plough set so that the point just cleared the ties. This loosened material was shoveled by hand to one side and left for the shovel to load. On this section some hard shale was found about 6 inches from the grade, but the shovel had no trouble cutting through.

As this was the first time a steam shovel had ever been used in the city of Newburgh many predictions of failure were heard from the "sidewalk inspectors," but after the shovel had scooped several dippers of macadam in solid chunks they were convinced that it would excavate the entire street. Water for the shovel was had from a pipe line laid the same as for the mixer with a 3-4 inch tee every 50 feet.

Fine Grade

A fine grade gang of ten men followed closely behind the shovel, grading to stakes set from the grade line stretched from curb to curb. Rolling was done with a ten-ton Buffalo Pitts steam roller. About 600 square yards of fine grade was the average per day.

Concrete Foundations

A concrete base 5 inches deep was then laid, the mixture being 1:2½:5, screened sand and 1½ inch stone. A No. 14 Koehring batch mixer of the traction type,

*Member of the Society.

equipped with a 20-foot boom and automatic dump bucket, was used.

On Section 1 the material was placed in three piles, a row of sand in the center and a row of stone on either side. Cement was placed on the sidewalk in piles at intervals of 50 feet. Material for these stock piles was figured beforehand so as to have just enough material dumped to supply the mixer without any extra wheeling. One man handled the operating lever on the boom and dumped the bucket, wherever concrete was wanted.

The boom can be swung to an angle of 180 degrees and the street being 40 feet wide was taken care of easily. The bucket was provided with an automatic tripper, which dumped and closed the bucket at the will of the operator. The concrete was leveled by hand shovels to pins set to the grade line stretched from curb to curb. Care was taken to have the concrete finished smooth, as only 1-2 inch cushion was used to lay the asphalt block.

The day picture was taken, 1,010 square yards of 5-inch concrete was laid in eight hours. Owing to the shortage of material the average on this section was 800 square yards per day. The gang consisted of one foreman, one engineer, one fireman and twenty laborers.

Asphalt Block

The wearing surface was asphalt block 2 inches thick, 5 inches wide and 12 inches long, weighing eleven pounds laid on a cement mortar cushion consisting of one part cement and four parts sand. This bed was struck with a template from a grade line marked on the curb.

Blocks were laid at right angle to the center line of street and longitudinal joints broken by a lap of 4 inches. (Picture No. 2.) The blocks were covered with a clean fine sand, perfectly dry, and swept into joints and allowed to remain on the pavement for thirty days.

The making of the mortar bed and laying of blocks was done under the direction of Mr. Fletcher Rogers, superintendent for the Hastings Pavement Company of New York. William J. Blake, Jr., city engineer, was in charge of the work.

COST-DATA

Excavation

The unit cost per square yard of excavation was as follows:

O Thew shovel.

Labor	0.069
Teams	0.109
Shovelman	0.008
Fine Grade	0.052
Coal & Oil	0.005
Overhead	0.004
Supt.	0.006
Gen. Expense—Bond & Ins.	0.005
	0.258

Concrete Foundation

The unit cost per square yard of concrete foundation was as follows:

Foreman	0.005	
Engineman and Fireman	0.007	
Labor	0.062	
Supt.	0.011	
Overhead	0.008	
Gen. Expense—Bond & Ins.	0.012	
		0.105
Cement	0.200	
Sand	0.090	
Stone	0.200	
Coal & Oil	0.010	0.500
	0.605	0.605

Curbing

The Unit cost per lineal foot of concrete curb was as follows:

Excavation	0.156	
Placing Forms	0.041	
Placing Concrete	0.112	
Relaying Sidewalk	0.058	
Hauling Stone, Sand	0.027	
Supt.	0.012	
Overhead	0.010	
Gen. Expensee—Bond & Ins.	0.012	
		0.428
Cement	0.087	
Sand	0.045	
Stone	0.033	
Corner Bar	0.146	
Steel Forms	0.032	0.343
	0.771	0.771

Road Construction Cost

In 1904 the total expenditure on all public roads in the United States, was $79,771,417. In 1912 the expenditure amounted to $164,232,365, more than twice as great. The expenditure per mile on public roads in 1904 was approximately $37.07; in 1912 it was $74.65. The expenditure per inhabitant in 1904 was $1.05; in 1912, $1.78.

The greatest progress in road building has been made in the states which contribute from their treasuries toward the construction of state aid or trunk line roads. In 1904 there were thirteen states that contributed out of a general fund $2,607,000; in 1912 there were thirty-five states which contributed $43,757,438.

Discussion of Thomas H. Ray's* Paper

"THE HUMAN ELEMENT IN PUBLIC CONTRACTING LAW,"

Published in December, 1913 Issue

Mr. Wm. L. Bowman: It must be borne in mind that our attempt is not so much to change the present laws as to make one uniform and comprehensive statute cover our many statutes and the law as it is.

Our professed law is drawn with regards to contracts in municipalities other than New York City. It is framed to cover the situation in the entire State. We realize that this city is well protected; the difficulty here is to protect the contractor.

The Corporation Counsel may pass on contracts, but he may not later stand by his own decision or that of his predecessors. Again some successor may construe them in a different way. The result is that often the contractor finds he has a contract which is different from that which he thought he had, and different from the mutual understanding when it was signed.

Regarding suggested arbitration, suppose one of the arbitration judges is a former Corporation Counsel. He would unquestionably construe the contract as he did when acting in his former capacity. In my own experience, I have found that a large percentage of the city cases are dismissed by the trial judges. You must depend on the appellate courts for the law in any particular case. Hence personally I do not favor Mr. Ray's suggestion as to the personnel of his arbitration board.

I disagree with his allegation that plans and specifications cannot cover fully all the emergencies that may be met. In my opinion we must insist that the engineer know his business, and that unknown conditions must be determined with as much accuracy as possible by preliminary borings, explorations, etc. The expenses involved in these preliminary determinations are certainly less than the cost of law suits which may result from unforeseen conditions, arising during the execution of the contract, and which are not covered by proper and complete contract clauses.

My idea is, that there should be an understanding that definite work is required for a definite figure with a cost plus percentage for contingencies.

Copying old specifications is often the cause of the trouble. A still greater source of trouble is the provision that exists in most contracts to the effect that before a contract is completed a certain official must be satisfied. What does that requirement add to the contract except to put a club in the hands of such official? It adds nothing legally to the contract in most jurisdictions. The work done in accordance with the directions of the engineer or of the official and pursuant to the places and specifications must be satisfactory.

In Pennsylvania under the present law, the satisfaction of the engineer must be absolute, unless it is proved that he is in collusion with his employer and as you all know that is very hard to prove.

Regarding the unification of contracts, there is, I think, just as much reason for this as there was for the unification of the laws respecting bills and notes. Large contracting concerns are not local. They have officers in different states and cities. It requires much labor and expense on their part to look up the laws of different States, municipalities, etc. Therefore, I must disagree with the conclusion that uniform contracts and specifications are not feasible or necessary. In fact, in my opinion, such uniformity would be a long step toward assisting contractors in knowing what they could or should do.

Often contractors go to other States without looking up the laws which may be a great deal different from those of their own State. In this way they may get into serious trouble even to losing their compensation for honest labor and benefit conferred.

Mr. Edw. Wegman:* Borings often give indications, which are found in actual construction to be incorrect. This is especially true of wash-borings. Diamond drill borings give better results, but even these are occasionally misleading.

The New Croton Aqueduct crosses the Harlem River in a deep tunnel, about 300 feet below tide. Before the contract for this work was awarded numerous borings were made with a diamond drill. They showed a pocket of disintegrated rock, about 300 feet from the shaft on Manhattan Island from which the aqueduct tunnel was driven.

From the indications given by the borings, the engineers felt confident that if they located the tunnel 150 feet below tide, they could have at least 30 feet of solid rock above the tunnel. When the heading reached the pocket of decomposed rock, it was found that the latter instead of terminating 30 feet above the tunnel, extended to a depth of 75 feet below the tunnel. The heading had to be abandoned; the shaft on Manhattan Island was sunk 150 feet deeper and the tunnel was constructed 300 feet below tide, instead of 150 feet, as shown in the contract drawings.

The contractors, who had undertaken to construct this aqueduct tunnel, brought a suit against the city in 1891 for the extra expense caused by having to perform their work at a depth of 300 feet, instead of 150 feet below tide. This case has not yet been finally decided by the courts.

The party making the borings should be responsible for their correctness. There should be some provision in the contract which would allow it to be amended or terminated if the actual conditions are found to be very different from the indications of the borings.

In the Croton Dam case, the trouble arose from the fact that engineer ordered contractor to use concrete instead of Cyclopean masonry. The contractor accordingly made the substitution, but later could not collect the increased cost because it was decided that the order was not legal unless the Chief engineer and Commissioner sign a request to that effect. The contractor, therefore, could not recover, because again in this case equity was not considered in the least.

In another case, connected with the construction of the new Croton Reservoir, the contractor had to supply all the iron work for the new reservoir. The Chief Engineer instructed the contractor to place the iron railing all around the reservoir, but the Comptroller who was a former Corporation Counsel, later on held that he was not entitled to full payment, because it had not been specified in the contract that the iron work was to be placed at every point around the reservoir. Finally after holding up the matter for five years the Corporation Counsel, admitted he was wrong, and the contractor recovered, but lost the interest on the $15,000 which was tied up for over five years. These cases show that even admitting the excellence of the present city charter, the contractor is quite liable to be subjected to very unfair treatment.

Mr. C. Freund:* The application of quantity system should solve a good many of the difficulties experienced in the excution of contracts. If the schedule of quantities is prepared by an official quantity surveyor, who determines and guarantees the quantities of materials and work required before the plans and specifications go out for bids, the contractor can then submit his estimate based as nearly as possible according to the unit schedule. If in addition proper provision is made for extras there is no reason why much of the uncertainty and risk of contract work should not be eliminated.

Mr. Wm. B. Bamford:* It is necessary that we codify the essential features of the New York Charter, which is good in many phases, and half of them are incorporated in our proposed law. The same could be done with more equitable provisions that may be adopted in other sections of the State, thereby securing uniformity. In any case, the conditions under which municipal work is let by contract, should be the same in all localities, at least, so far as the fundamentals are concerned.

We should provide an Arbitration Act the same as the English Act. It is strange that none of our States have such provisions. The New York Chamber of Commerce regulations regarding arbitration are a good example of a method for a basis for an optional appeal by the contractor, if he does not wish to accept the decision of the engineer as final.

Standardization of the best practice with regard to contracts, is decidedly advisable. Undoubtedly the New York Charter provisions are quite good as regard the public, but far from being so for the contractor. But in any case, its best features should be applied to other localities.

As regards the adoption of Webster's Dictionary, I understand that it has been so adopted by the Supreme Court of the United States, and also later adopted by Congress.

If it is not found sufficiently concise or correct for our purpose, something better must be devised.

Mr. F. A. Snyder:* I think that Mr. Ray is to be congratulated upon his excellent paper. The relations between the engineers and lawyers who draw up contracts and the contractors who endeavor to carry out the same, should be drawn closer.

*Member of the Society.

Mr. Ray's suggestion that this Society co-operate with the City Legal Department, is an excellent one, but we should also work with the Engineering Department as well. By doing this, in the case of contracts, many objectionable clauses, both in the contract and in the specifications, will be eliminated.

Most of the large public work is projected a long time in advance of the date when bids are asked, and if contractors who are interested and expect to bid on such work, would request that they be allowed to go over such contracts, plans and specifications, I feel sure that the Legal and the Engineering departments would be very glad to have them do so. I know that such a review would benefit all parties, as it would tend to make bids more uniform; the work would be done better and at a less cost, and needless fusion eliminated.

In regard to arbitration I consider that it is a very important thing in connection with the carrying out of a contract. As a general rule there is a clause in most contracts, "that the decision of the engineer shall be final and conclusive." This is a fine clause for the engineer, but absolutely unfair for the contractor. The engineer is the judge and the jury, and no matter how fair he may naturally be he will favor the people for whom he is working.

Mr. Wm. R. Galbraith, Vice-President: The Institution of Civil Engineers, Great Britain, in the discussion of the Rotherhithe Tunnel, by E. H. Tabor, M. Inst. C. E. (Vol. CLXXV., p. 28), stated as follows: "Quite apart from tunnel, it has struck him that if an engineer had a dispute with a contractor the sooner he went to the arbitrator the better. As a rule, the evil day was put off until the end of the contract, when half the circumstances were forgotten. On the Charing Cross and Hampstead line, Sir Benjamin Baker acted as arbitrator, and when some bad ground was reached at Euston he settled the difference at a day's notice, visiting the work and deciding in favor of the company. The contract was wound up without the slightest trouble. The disputes that went on in former days in Scotland and England were terrible. He could remember when contractors began to start claims the day they signed the contract, and obtained awards for ten years after the railway was opened."

I do not know how this method of arbitration was provided for in the contract, but it seems to me that if such a provision was inserted in every contract that it would save a great deal of friction, law suits and failures of contractors.

Mr. Edw. Wegmann: It is clear from what has been stated heretofore that contracts as now made even under the very good conditions of the New York Charter are not equitable. For instance, if the city is the cause of delay in the work the contractor is entitled only to extension of time. Suppose the delay is very long, the contractor should not suffer if his work is going to be more expensive, because very often the delay makes it necessary to do contract work in a different season than was anticipated.

Mr. H. H. W. Jorgenson:* It may be interesting to remark that a new system in awarding contracts has been recently adopted in Germany. Instead of the work being awarded to the low bidder the award is usually made to the bidder whose estimates are about an average of the total amount of the bids submitted. It is claimed that this insures economy and that the work will be done to the best satisfaction of all concerned.

As regards the quantity system it is my opinion that in Europe it should work out more satisfactorily because there piece work and labor conditions are different. It is doubtful whether the system can be used conveniently in the country where labor unions are opposed to piece-work and prohibit same.

Mr. Wm. L. Bowman: I do not agree with the last speaker that contracts on the unit quantity system will not prove satisfactory in this country. One of the most convincing arguments is the fact that most of the road contracts are now on the basis of unit quantities. I do not see any insurmountable difficulties against the adoption of the quantity system to our conditions in this country.

Mr. Thos. H. Ray:* While it is probable that your revised draft of the proposed law may have corrected some of the defects pointed out, a hasty reading of it convinces me that it still contains many objectionable features, and is wrong in theory.

It has been said that the aim of the Society is "to improve laws—not to change them." This is a worthy ambition but the question is how is it to be done and are you proceeding in the way which will give the most certain and immediate results.

It has been remarked also that the law has been drafted with a view to covering not only New York but also all municipalities, particularly the smaller towns—to make one uniform statute, for use throughout the State and nation.

It is submitted that this is both an impossible and unnecessary task. It is believed that the problems in question can best be attacked locally. With the various forms of local government now prevailing, such as the commission form as opposed to the more common form of city government, and because of the innumerable varying circumstances which may effect the awarding of contracts, no general statute covering the matter seems feasible. For this reason the New York Charter has been so freely referred to in the paper read—not to show how good our system is in New York, as a matter of contract law, but more as illustrating certain principles of local administrative government. It is not claimed that the New York Charter is by any means perfect, but it illustrates a possible system of checks and balances, with a central board of control, which does away with the dangers of allowing a certain amount of discretion to the city officials. And to the extent of the theory of government illustrated it may be pointed to as a model which with the necessary variations might be made adaptable to any local situation. But when you attempt to make a general statute applicable at once to New York, with its 5,000,000 people and the town of 500 you are bound to run into inconsistencies; you are bound to have many conflicts of statutes, general and local, which will inevitably result in greater confusion and endless litigation.

There is no similarity whatever between the circumstances making necessary a uniform law on "negotiable instruments" and a uniform law on "general contracting." While it is true that contractors often work away from home the status of the work and the law applicable to the contract under which it is performed is the same.

You will understand that no objection is being made to any attempt to standardize contracts and specifications. But no new legislation is necessary to accomplish this. It requires rather a co-operation between the officials who prepare the contract and those representing the contractor. Objectionable clauses commonly found in contracts should be attacked one by one. For example attempt should be made to secure more reasonable provisions protecting the contractor against loss from delays, failure to inspect and approve work promptly and thus start the time of guaranty running.

And contractors should learn to read and study their contracts and specifications before they begin work and not afterwards. The fact that they do not do so, is the root of many of their troubles.

No matter where a discussion starts on this subject it always comes back to the question of indefiniteness of specifications, and the discretionary clauses. The question then to be honestly answered is: "Can the engineer tell exactly what will be required?" If he cannot, and it seems certain that he cannot, there is no use in writing a new law to tell him that he must do so. Make sure that he does so as nearly as he can—and make the best of it. Provide that under certain circumstances the contract may be cancelled on certain conditions. This was done in some of the canal contracts. Of course there was litigation about it, but the cases were decided on the same theory that others had been years before. And most questions which come up or can come up have now been adjudicated. So that one who will now take the trouble to examine the law can come pretty near to learning what it is. But it will not do you any good if you don't look it up until after your case is over.

With the benefit of such past litigation, a reasonably fair and understandable contract can now be written. But if those to whom the duty of preparing the contracts is assigned merely rehash and copy past contracts, without paying the particular attention to the present circumstances which each case demands, the result will be the usual common jumble.

So that one big objection to writing new laws is, that now when after the expense of many years and millions of money in litigation, we have adjudications on nearly every conceivable question, you will start again on new rounds of litigation to untangle the legal knots which your law will positively tie.

Another theoretically good provision of the New York Charter deserving of mention is that which permits recognition and payment of an equitable claim against the city by an unanimous vote of the Board of Estimate. It may be that little use is made of this provision, but that is not the fault of the law. The answer to this like that to so many others could probably be found more easily in a study of human nature than in law.

You can get results at once which will be of permanent benefit to the contractor, in the manner suggested—that is by making some small improvement here and there as occasion offers. If you wish to pursue the more spectacular method of reform, by much proposed legislation, you will undoubtedly for a time attract considerable attention—but end as a mere flash in the pan and your supporters will gradually fall away. Contractors are practical men, they desire results, not talk.

SOCIETY AFFAIRS

Delegates Visit Municipal Asphalt Plant

Delegates representing this Society made a joint inspection tour of the new Municipal Asphalt Plant in Brooklyn in conjunction with delegates from the Brooklyn Engineers' Club, the Municipal Engineering Society, and the Brooklyn City Engineers' Club.

This plant is the largest in the world and was constructed by the Northeastern Construction Company of New York, and cost approximately $120,000.

Encouraging Letters

The following are abstracts taken from interesting letters received from members and non-members. They will give you an excellent idea of the co-operative and appreciative feeling which is stimulating the ranks, also an insight on the favorable impression made by our new publication and Society activities upon the engineers and contractors not already members.

St. Louis, Mo.

Further we would like to add a word about the unusually good appearance of your front cover. The absence of advertising and the good color scheme used, gives an attractiveness which, in our opinion, offsets any theoretical loss from not using part of the page for advertisements. This publication should do *more* to further adfance the A. S. E. C. than has any one medium to date—there having been a "something" lacking to develop or even *hold* the enthusiasm of the individual members until the Society became older and firmer.

Yours very truly,
WM. P. CARMICHAEL CO.,
By H. M. Cryder,
Vice-President.

Washington, D. C.

I have read everything, including advertisements, in all the journals which you sent recently, which is something I do not do in any paper and have found the reading interesting as well as loaded with valuable suggestions.

Very truly yours,
Charles H. Hoyt,
Civil Engineer and Contractor.

Santa Marta, Columbia, S. A.

My friend, Mr. E. P. Robb, of New Iberia, La., of member of your organization, has advised me to apply for membership, and upon hearing the objects of the Society, I certainly wish to be put up for election.

Yours very truly,
C. Gore-Langton.

Toronto, Canada.

Mr. Tromanhauser has been handing me copies of your monthly paper and I am very much interested. I feel that the cause is a good one and I think it would be possible to secure quite a few members in this part of the country. Will be pleased to receive some literature and application forms from you.

Yours truly,
H. E. Harcourt,
Secretary and Treasurer J. H. Tromanhauser Co.

Shreveport, La.

I am interested in your Society and think that it fills a long felt want, though I know very little of the requirements for membership. If I am eligible for membership, I will put in my application.

Very truly yours,
A. W. Jackman,
General Superintendent.
Dullut & Williams.

BRANCHES

Chicago

The first annual meeting of the Chicago Branch of the American Society of Engineering Contractors was held at the Auditorium Hotel at 4 p. m. February 18th, with H. F. Hackedorn of Indianapolis, first vice president of the National Society, in the chair. Resolutions were passed adopting the regulations and by-laws of a Branch Society after an explanation of same had been made by T. Hugh Boorman, National Treasurer.

The following were elected officers for the present year:

DeWitt V. Moore.....*Chairman*
Carl Weber.....*Vice-Chairman*
C. W. Boynton.....*Treasurer*
James C. Campbell.....*Secretary*
John T. Wallbridge.....*Director*
E. S. Hanson.....*Director*

There were present H. F. Hackedorn, of Indianapolis, First Vice President; T. Hugh Boorman, Treasurer; DeWitt V. Moore, Carl Weber, Directors of the National Society, and John T. Wallbridge, C. W. Boynton, J. C. Campbell, H. S. Doyle, T. C. Schaub, and D. W. Stradling representing Engineering and Contracting; C. A. Cooper of Chicago; H. B. Pullar of Detroit; Robt. S. Low and David Barry of Ottawa, and H. V. Van Scoyoc of Montreal, all members of the American Society of Engineering Contractors. Others present were T. H. Warder, Secretary of Western Society of Engineers; Elmer C. Jensen, President Ill. Chapter A. I. A.; W. H. Finley, Chief Engineer C. & N. Ry.; Bldg. Comm., Henry Ericson, Benj. F. Affleck, Edward D. Boyer, Julius Flots, Wm. Seafert, George C. Baker, and Edward E. Krause.

Preliminary Meeting of Philadelphia Branch

The first meeting necessary in the preliminary steps for organizing a Philadelphia Branch, was held in the Engineers' Club of Philadelphia, February 21st.

Among those present were: Oliver R. Parry, J. Walter May, C. C. Mason, T. Hugh Boorman, F. V. Warren, Manton E. Hibbs, John C. Trautwine, Cassius E. Gillette, James Kelly, George D. Steele, W. A. McIntyre, C. Burke Filbert, Jos. C. Rock, Richard Gulpin, Henry L. McMillan, J. Russell Wilson, Halbert P. Gillette, Messrs. Wegmann, Wemlinger and Pomeroy, of New York being unable to attend the meeting, it was decided to adjourn until the 14th instant, at which time officers of the branch are to be elected.

ENGINEERING LAW

ANSWERS BY WM. L. BOWMAN, C. E.*
Attorney at Law, New York

Question. Our company has a building contract which we are at present working on. On another job we had a serious accident which has and will continue to hamper our available working funds and our ability to get loans. The owner knowing that, has refused to pay an installment now due unless we will give him a bond or security that we will complete his work. We have a heavy liquidated damage clause and we will have all we can do to get the work done in time. Can we stop the work and if we do what are our rights against the owner?

*Member of the Society.

Answer. Yes, you can under these circumstances cease further performance on your part. Some cases state this to be a breach of contract which justifies abandonment by the contractor and others say that while it should not be called a breach of contract yet it is a valid excuse for a recission of the contract on the contractor's part. However, the damages which you can collect for such action on the owner's part do not include the profits you might have made had you been permitted to complete the unfinished work. Your recovery will be limited to the reasonable value of the work actually done.

Question. The writer was employed as engineer in charge of large construction work and received very good pay in such position. The work being completed, I have left that employer and am now with other people. There are several law-suits now being prepared for trial involving my previous work. My former employers have asked me to help their attorney during my spare time and apparently expect me to be the most important witness. Nothing has been said about pay but I have an idea they expect me to do it for what I received in the past. What are my legal rights?

Answer. Any work that you do assisting the attorney, preparing to testify, or preparing to state on the witness-stand opinions as an expert are services which you are entitled to be paid for. That is true whether there is an agreement to pay you or not, but to save trouble you should

have it understood and also the rate fixed and agreed upon. You can of course upon an ordinary subpoena and upon payment of the legal witness fee be compelled to attend the trial and testify as to what you did, saw or heard regarding the work. Strictly speaking you are not entitled to any additional pay for that service or testimony, or as long as you are not required to give professional opinions and support them on cross-examination. An interesting case along this line was lately decided where the engineer was employed to act as an expert for $50 a day. He attended and testified until about half of the cross-examination was completed and then refused to attend or testify further until he was paid for his charges to date. The defendant then subpoenaed him and he was compelled to complete the cross-examination. He was refused his pay and upon action brought, it was held that his refusal to complete his testimony was a breach of his contract and hence he could not recover for his services as an expert.

ACCOUNTING DEPARTMENT

Conducted by HARRY M. SMITH,*
Certified Public Accountant, New York

It was stated in last months' issue that our idea was to confine the activities of this department to accounting matters and for the present, at least, not to engage in a discussion of cost systems, as that subject is being handled by proper committees of the Society.

In the same issue there was published the report of the Committee on Cost Accounting, upon which the comments of the Society at large were invited, the purpose being to aid the committee in their final report and it is with this idea in mind that we decided to discuss certain phases of that report.

While we are not entirely in agreement with certain statements made in that report our further remarks are not intended as any reflection on the work of the committee. We are merely expressing our opinion. No doubt, exception will be taken at times to certain statements that may be made in this column. However, better progress will be made in that way and we shall be glad to have such members as are interested, send in their comments favorable or otherwise.

Now as to the subject matter of the report referred to, the statement was made that while many systems have been under consideration, a large number of them are more suitable for the factory than for the engineering contractor engaged in actual field work where many diverse conditions are to be met. It was also mentioned that such systems are so involved that the cost of maintaining them would be prohibitive and that an elaborate system would be more readily utilized in a factory where a number of skilled workmen are employed some of whom would take pleasure in keeping cost records.

In dealing with the foregoing, we are aware that particular reference was made in the report under discussion to the systems that have been under consideration, it is our purpose to speak of the actual application of the following points as we have seen such in actual factory accounting.

1. Conditions: Everything considered we are of the opinion that, in-so-far as the difficulty of obtaining costs is concerned, in a factory where a large number of articles of various kinds, with numberless styles, sizes and finishes are manufactured, that the conditions to be met fully equal the diverse conditions imposed upon the engineering contractor in the field.

For instance, dies must be made for each variation of size and style of the goods manufactured; materials of each kind must be recorded and delivery followed accurately; freight and handling must be properly applied; the pay roll must be segregated and spread where it belongs, the division between direct and indirect labor frequently proving a troublesome matter. So it goes on through all items entering into the costs, each of which proving to be a problem to the manufacturer in determining the cost of each of the various articles that he produces.

Again, the average factory workmen objects to clerical duties of any kind, and cost records being rather exacting are particularly onerous to him. The human element in all branches of business is about the same and it will be found that the good foreman in a factory, where he is required to keep certain records for cost accounts, will do just as his brother foreman in the field. He will follow the lines of least resistance and will obviously do considerable guessing, thereby imparing the accuracy of the costs.

2. Cost of Maintenance: The average manufacturer somewhat like the small contractor, feels that he cannot afford the expense of keeping accurate costs, although in a measure it is a short sighted policy. Reasonably accurate costs are a great benefit, not only for the purpose of ascertaining whether a profit is made on a certain piece of work, but they are also of value in estimating on future jobs. Certain work which had been taken at a certain price would not have been taken had the cost of jobs along similar lines been known. Again, certain other jobs might have been secured if it had been known just how low the estimate could have been made.

Between the two classes mentioned, it would seem to us that to obtain accurate costs it would be much more expensive for the manufacturer, inasmuch as he is dealing with a great variety of articles and he is not in any better position to afford the expense. The contractor handling large jobs should operate a cost system at practically a minimum expense.

Another point: In the factory various jobs are passing through the shop at the same time, with a number of others of an entirely different nature thereby adding to the difficulty. The contractor's jobs are located in different places, which in itself tends to simplify matters.

3. General: It is reasonable to state that cost systems of any nature to be of value must be accurate. In order that this may be accomplished, they should be incorporated in the general system of accounting employed. In other words, the cost records, however simple, should not be kept independently and apart from the other accounts of the business; or in a hit or miss fashion, certain items being entered and others being forgotten.

If the thing is worth while at all, it is certainly worth doing properly. According to the simple method suggested hereinafter, there is no reason why the bookkeeper who may be situated in his employer's office a great distance away from the job, cannot keep fairly accurate costs and at a minimum expense of operation.

From a theoretical point of view, the cost records of a contractor whose operations are usually on a larger scale, should be susceptible of a greater degree of accuracy than those of the average factory. The elements of cost in both cases are the same:

Material
Labor
Direct Expense
Overhead Expense

It is usually in the application of these items to proper cost sheets, so that they will agree with the general record, that difficulties arise.

The material, labor and direct expenses of each job are distinct and as such, must pass through a general office for payment. Therefore, it would seem possible to apply them on proper cost sheets which may be sectioned to any degree desired.

The factory on the other hand, buys raw or partially completed material and engages labor to produce a completed article. The articles manufactured, unlike the contractor's job, are concentrated in one spot and such, if they are small pieces of various sizes, shapes and finishes, are as a rule, difficult to handle, as regards cost of production; the overhead expense usually proving to be the greatest difficulty.

Consequently, we are of the opinion that a contractor is in a better position to obtain costs and with a simpler system than the average manufacturer. In designing any system of costs, the desires of the individual must first be considered; one desires certain data and another requires something entirely different; this one is keen for details; that one is satisfied with general results.

Now to deal with a concrete system of simple costs, we recall the accounts kept by a very large building contractor. When he secured a contract two accounts were opened on his general ledger; one, with the person or concern awarding him the contract, being charged with the amount of the contract, and another which was credited with a like amount. The first of course, being the asset account, was credited with such payments as were made, and the balance at any time represented the unpaid amount of the contract. The second, being the liability, was charged with tools, machinery, etc., chargeable to the job, pay roll items, sub-contracts awarded to other contractors for portions of the work, and such expenses as were directly applicable. When the contract was completed, such as machinery at a depreciated value, unused materials, etc., were credited to the job, and the balance was regarded as profit or loss as the case provided.

In a general way this proved to be a very simple method of obtaining the cost of a

* Asso. Member of the Society.

job, although it provided only for direct charges and did not take up overhead expenses of any nature. Nevertheless, it gave a simple method, under a double entry scheme of bookkeeping and satisfied that particular contractor.

There is no reason why that method could not be followed although there are many objectionable features about it; for instance, it would not be reasonable to furnish a bank a statement prepared from the books showing the entire amount of the contract as an account receivable if the job were but 25 per cent completed. Due allowance of course would have to be made. Again the contract might cover several fiscal periods and difficulty would be encountered at once as to how the books should be closed allowing for the uncompleted part of the job.

We believe, however, that with due care this method could be amplified and that cost sheets that would furnish all necessary details could be kept resulting in a simple and effective system. Such sheets could be made as detailed and as elaborate as desired; for example, material could be kept on a separate sheet with complete details as to the quantities and costs in totals or by units; labor on another sheet, segregated in any manner desired, showing for instance, on excavating, the progress made. Large tools and machinery, accounts, likewise, to be kept on a separate sheet with proper columns for repairs and upkeep as well as the estimated depreciation; this could also be provided with a space for location so that in case of accident at a certain point, it would be known just what machinery was located there. A fair claim could then be made for the proper insurance involved; small tools and breakable parts could be shown, but they, of course, would probably not have much value at the completion of the job. Obviously a summary should be provided which would combine all of foregoing and would indicate clearly the whole direct cost of the work; this in turn would agree with the contract account in the general ledger, and the general overhead expense would be added later from the general accounts on an accepted basis.

It will be noted that but the mere outlines are provided in the foregoing, as details are a matter of individual requirement.

EMPLOYMENT BUREAU

Men Available

Actuated by a desire to be of direct assistance to all of its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

003 Junior member of this Society, twenty-three years old, single. Education at Stevens' Institute of Technology, Mechanical and Electrical Engineering. Present position as chief operator in sub-station of an electric railway and light company. Has been employed with three large corporations in the following capacities: Assistant to engineer of tests, start and run tests on boilers, turbines, generators, engines, pumps, etc. Responsible for results. Inspection and analysis of efficiency; able to operate switchboard, put in turbines, etc. Cadet engineer, laying gas mains, erecting pole lines, keeping records of meters, transformers, lamps, etc. Generator tender and switchboard operator. Record A-1.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, drydocks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

The Qualifications of a Contractor

In the course of a speech at the annual dinner of the Contractors' Protective Association of New York, Capt. D. L. Hough, president of the United Engineering & Contracting Co., of New York, summed up in a few words the qualifications required of a contractor. He said:

"There is no class of work that takes as varying qualities or so many qualities as contracting. It appeals to men who are optimistic and to those who have born in them the longing for doing things. The contractor must be a man, first, possessed of that most uncommon thing, commonsense; and he must have physical sense, the sense that tells a man without calculating where lies the center of gravity; the sense that tells a man quantities without measuring. He must have magnetism in order to gather his men about him. He must have a reputation for justice in order to hold them. He must be forceful in order to inspire energy in others. He must be a lawyer and buyer. He must have the ingenuity of the inventor and the grasp of the field-marshal. He must be a diplomat, and he must be a politician. He must also know when not to be a politician. He must be a financier, and, I regret to say, in these days, an advertiser, and he must be a prophet." —*Steam Shovel and Dredge.*

Department of Agriculture Issues a Report

The United States Department of Agriculture recently issued a "Review of Forest Service Investigations" Vol. 1. The report states the objects and plans of the department. Investigating work and tests are carried on in a large and well equipped laboratory at Madison, Wisconsin, in co-operation with the University of Wisconsin. They have forest experiment stations, in the central and southern Rockies. These stations have been established for intensive study of Silvicultural problems. The major divisions of other investigation work are "The Mechanical and Physical Properties and Structure of Woods," "Wood Preservation," "Derived Products," and "Statistical Study."

The Department of Agriculture, Forest Service, desires the co-operation and interest of members and wishes to keep closely in touch with practical commercial problems. Suggestions or inquiries addressed to "Director, United States Department of Agriculture, Forest Products Laboratory, Madison, Wisconsin," will receive careful attention.

THE EXAMPLE SET BY GEORGE WASHINGTON

"Let me go off quietly," said Washington with his dying breath. He died, as he had lived, bravely but modestly.

On this, the one hundred and eighty-second anniversary of his birth, it is perhaps more pertinent to reflect upon his personal attitude to public office than upon all his glorious and useful service to the nation. What Washington did is with us still. Daily we reap the benefits of his wisdom, the results of his devoted efforts for his country. What Washington was lies in the memory of no man. His personality, his habit of life, his mental attitude, the thousand and one details that go to make up the study of a man—these we can but glean in an incomplete fashion from the books and letters and reminiscences of another century.

This is the age of self-aggrandizement. What a man is and what he does must be loudly proclaimed from the housetops, lest he and his achievements be lost in obscurity. Advertisement is the watchword of the day, and self-advertisement the surest way to success. The successful politician must be ready and willing to assert at every opportunity that he is the best man for an office, just as the successful shoemaker must assert his superiority over all the rest. Modesty is equally fatal in commerce as in politics. More and more as the years go by is the tendency growing for one man to usurp so far as he can all the functions of government. And the type of public official chosen by the people is coming more and more to be the self-assertive, aggressive man, greedy for power and confident that in his greatness—and in his greatness alone—is the future of the nation dependent.

George Washington was not such a man. Throughout his public life he was consistently sceptical as to his fitness for the positions to which he was successively called. The office always sought him, never he the office. One wonders if, for all his wisdom and fitness, George Washington's innate modesty would not have precluded him from attaining high public office in these days.

When Washington was tendered the appointment as commander-in-chief of the armed forces of the United States Colonies he called upon "every gentleman in the room" to remember his declaration that he did not believe himself equal to the command, and that he accepted it as a duty made imperative by the unanimity of the call. Fancy a prospective commander-in-chief today accepting his post with such a reservation! Who in these times could have faith in a man who doubted his own capability?

At the close of the war it is more than probable that Washington could have made himself king were he possessed of an inordinate greed for power. The proposition was even made to him in a letter from Colonel Nicola on behalf of the disgruntled army officers before peace was formally declared. Washington's reply was prompt and unequivocal. "If you have any regard for yourself or posterity, or respect for me," he wrote, "banish these thoughts from your mind, and never communicate, as from yourself or anyone else, a sentiment of a like nature."

The same point of view was consistently maintained in his conduct as Chief Executive of the nation. Never did he attempt to dominate the legislative or the judicial branches of the government. The man who might have been king was content to serve the people humbly, modestly and wholly as they wished to be served.

The example George Washington set in public office is not one of the least considerable of his legacies to the nation. It is an example which every public official may profitably follow.—*New York Press.*

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY
OF ENGINEERING CONTRACTORS, INC.

AM. SOC. ENGINEERING CONTRACTORS 1909

Volume II—No. 3
NEW SERIES
MARCH, 1914

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Published Monthly by the *American Society of Engineering Contractors, Inc.*, 11 Broadway, New York City, N. Y.

Copyrighted 1912, by the American Society of Engineering Contractors, Inc.
Entered as Second-Class Matter April 16, 1912, at the Post Office at New York, N. Y., Under Act of March, 3, 1879

Entered according to Act of Congress, by the American Society of Engineering Contractors, Inc., in the Office of the Librarian of Congress, at Washington, D. C.

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THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, MARCH, 1914 Number 3

To Build Without Providing for Maintenance is Silly

THERE is much said and written about roads. Too much of the wrong kind of stuff.

¶ Like everything that the American people take up in earnest, from trust "busting" to pure food, the subject of roads, after long neglect, is treated, discussed and dissected with an effervescence and lavishness that is simply overwhelming, if not always judicious and convincing.

¶ The trouble is, that far too much consideration has been given to the question of construction and too little to the important matter of maintenance. We are told by experts and near-experts how to, and not to, build roads. Some say there's nothing like brick; very likely they have the little bricks for sale. Others say tar is the real thing; perhaps they provide the stuff whence comes the headache cure. Again we are told that nothing but asphalt is any good; but our advisor perhaps owns lots in the country which presented Castro to the world. Finally, to the chap who claims a piece of the Palisades-on-the-Hudson, other road materials are "not in it" with macadam.

¶ The subject, nevertheless, is worthy of all the attention it has received except that proper proportion has not been maintained.

¶ It is well to build a road of the best materials suited for the purpose, location and use, but why do that and then let the road take care of itself? Like a house, a road deteriorates from the time its starts its useful career.

¶ Therefore, maintenance should begin as soon as the road is finished, not when it looks like a piece of swiss cheese.

¶ The object of maintenance should be to prevent repair rather than to do the latter. That this will prove economical is clearly shown by Germany, where excellent roads are maintained in fine condition at all times and with more all-around efficiency than in other European countries.

¶ In this issue we publish a paper which gives valuable suggestions. First of all, it is written by a man who had to build, and above all, to maintain German roads. Secondly, it treats fully and intelligently of the organization upon which must depend the practical up-keep of the highway.

¶ It has been said by some writers that the great difficulty experienced in trying to organize maintenance of roads is to find the men who will, or can, do the simple but careful repair work needed. Mr. Weber points out that this is done by old men of Germany who live in towns traversed by the road and are in charge of a section that they can cover easily each day.

¶ We believe that's the solution of the problem. There is in every town or village on or near the highway, some old men, not very busy otherwise, who will gladly and faithfully do such work as is needed to patch up, smooth over, and fill in the bad spots in a road. They might be given each a section or two to look over. Such men would gladly perform duties of this kind more consistently and carefully than younger men. Their pay need not be high but proper supervision must be given so as to promptly detect a bad job.

¶ It would be a comparatively simple matter to organize such a force with the nucleus provided by road and highway engineers already in the employ of the County or of the State.

¶ Another important point that the author has emphasized is the desirability of standardizing road design. This is another matter which demands attention. With specifications properly standardized under the supervision of men familiar with the design and the construction of roads, much of the uncertainty and poor work done in so many cases would be eliminated.

¶ The American Society of Engineering Contractors would welcome suggestions that will help to crystallize the joint experience and knowledge of its members and others who see the necessity of standardizing road design and adequate maintenance.

Highway Construction and Principles of Organization for Highway Maintenance Work

By CARL WEBER, Consulting Engineer*
2434 BURLING STREET, CHICAGO, ILL.

One of the most important engineering problems of the present time is the construction of good country roads and public highways. There is shown an intense interest in this work in every part of the United States and large sums of money are now being used for this purpose in every section.

Wonderful progress has been made within the last few years and although by far the largest part of the contemplated work remains yet to be done there is no question at all that within a reasonable time the United States will have closely connected Highway Systems at least equal to the best of those in European countries.

The importance and economic value of good roads for the welfare of the nation and the benefits to be derived from their construction are becoming more and better recognized, and it would be a waste of time to even mention here all the advantages which a good road system offers. It is a well recognized fact that the money which is wisely applied for public Highways is a high-grade investment, provided suitable arrangements are made for their up-keep.

Reference is frequently made to the almost ideal conditions of the country roads in Germany, England, and France, and it is surprising that these old roads have not been more thoroughly studied before the construction of some of the more important lines had been undertaken in the United States. A great deal of experimenting and a good many disappointments might have been easily avoided.

There seems to be no end to the complaints about the conditions of some of the newly built highways. Several of the new lines which were completed only a short time ago present a very soft surface full of roots and ridges which do not help to inspire the public with confidence as to the ability of the road builders. Large sums of money will have to be spent for repairs before such should ever be necessary.

There is nothing mysterious about the European roads. The only two reasons why they behave so much better under heavy use than many roads in this country are that they are built with considerably more care and the maintenance of these roads has been developed into a science.

I have been closely connected for many years with European road work and have surveyed, planned, built, and maintained large stretches of state roads in Germany. Being, therefore, intimately acquainted with every detail of road construction and maintenance as practiced in that country, I will endeavor to cover some of the principal points in the following lines:

By far the largest part of the German Country Highways (Chaussee's) are built very economically. The roadway surface usually consists of two distinct parts, the water-bound macadam road from 12 to 18 feet wide and the clay bound gravel road from 10 to 15 feet wide, called the "Summer Road." On both sides of the road are "banks" from 5 to 10 feet wide, which are used for storing the repair materials, etc., and on which the street trees are planted from 20 to 30 feet apart. This tree planting is not omitted on any street and is considered to be of very greatest importance. The trees not only provide delightful shade, but also contribute a large part to the cost of road maintenance.

CONSTRUCTION.—The construction of the "Chaussee" commences with the grading of the line. This is done in about the same manner as practiced in this country. The only difference is that the work is done more thoroughly and that not only the road-bed itself is prepared true to level and profile, but also all the slopes and embankments in cuts and fills are finished in the same manner.

All fills are thoroughly compacted and all slopes and embankments are covered with humus and seeded to grass. This seeding is done to protect the sides and ditches against the destructive action of rain and ground water.

The utmost care is given to the proper drainage of the road. Not only is the bed or "crown" provided with stone or tile drains, but all the side ditches along the road are properly protected. Long stretches of these ditches are often provided with concrete stone linings or retaining walls, and special care is taken to protect bridges and culverts against water damage.

Then the materials for the macadam road are hauled and distributed and this also assists in compacting and settling the new earth work. Very frequently the road is then left open for traffic for a few weeks for the purpose of thoroughly compacting the fills.

The stone road is usually built in the following manner:

After the bed has been properly leveled and trimmed according to the adopted templets, the "curb stones" are set along both sides of the macadam road. These curb stones are rough hewn stone about 10 to 15 inches long and high, and about 4 to 6 inches thick. They are set true to line about three-fourth-inch higher than the contemplated street.

Between the curbs a layer of about 1 to 2 inches of sand is evenly spread and then the "pack" or foundation layer is placed. This layer is made of broken stones of rough prismatic form with about 4 to 5 inches largest side measure. These stones are usually set by hand, on their bases, as closely together as possible with the points showing upwards. The spaces between the points are then filled with 2-inch crushed rock. The crushed rock is spread over the surface and a gang of laborers with light, long-handled hammers distribute the stones uniformly and wedges the same between the upright points of the "package" so that every foundation stone stands firm under slight side pressure.

This completes the foundation which at times is gone over with a light steam roller. This, however, is omitted where excessive moisture is apparent.

On top of this foundation the first layer of crushed stone, about 2½ to 3 inches thick, is placed, carefully leveled and rolled with medium weight roller, then immediately the second layer of fine macadam, about 1½ to 2 inches thick, is placed and this is rolled until the surface is solid. Then, while this rolling is still going on, a thin layer of fine sand is spread over the surface and this completes the stone road.

During the application of the second layer of macadam and the sand cover a moderate amount of water is used to facilitate packing and solidifying of the surface. The excessive use of water, however, must be carefully avoided.

This system of road construction is used throughout Europe with very satisfactory results and some of the streets so built are now over 100 years in service and are not showing any deterioration but seem to be getting better with age.

There are, of course, changes made to meet certain local conditions and to take best advantage of local materials, the general principles, however, remain the same, and although numerous other systems of highway construction have been tried and introduced, the cheapness and durability of a well constructed "Chaussee" could not be equaled.

The "Chaussees" were introduced in most European countries by Napoleon I, who was undoubtedly the greatest road builder who ever lived. He knew and appreciated the value of good roads for the movement of his large armies and wherever he occupied a territory, even if only for a short time, he left, as a souvenir, good roads which, in most cases, are still to-day in first-class condition.

Under his orders this rather complete system of construction was developed and it is still to-day followed in all over Europe with enviable results.

There are in Germany now hundreds of miles of Napoleon-built roads in use and they form the leading arteries of travel in the empire. These old roads are mostly built in straight lines up and down the mountains and one can often travel for hours without meeting a curved section. In present times the ideas about straight roads have, of course, been changed, and much more importance is given to easy grades than to straight lines.

No oil or tar whatever is used in the construction of the German highways and after comparing results with American and European methods I have come to the conclusion that the free use of oil, etc., in this country is largely to blame for the unsatisfactory results, especially in the Western States.

I would advise to use oil only in the finishing coat of the street where it will be of great benefit as dust preventer and as water proofing for the top surface. The benefit derived from using oil as a binder seems to be very problematical, and the results are certainly very often far from being satisfactory.

For city street conditions are, of course, entirely different and oil and tar macadam, etc., are valuable street building materials.

Within the last few years numerous experiments have been made, especially in America, with concrete for Highway construction with very gratifying results. Although it would be entirely too soon to form any conclusive opinions about the lasting value of concrete highways, it seems certain that concrete will have a very great future.

*Member of the Society.

There is no other material which, if properly used, offers so many advantages as concrete for road construction. It is almost ideal for this purpose, however, careful design and construction are indispensable requisites.

The first principles of road construction must always be the procuring of perfect drainage and proper foundation regardless of the materials and systems employed for the wearing surface of the street. However, I have seen in America many a new road built at great expense where these two points were not properly considered.

Millions of dollars could be saved in this country if Highway Construction work should be standardized.

STANDARDS.—A small number of standard profiles and specifications should be adopted for public highways to apply for streets of different frequency and purpose and of different width and character. For each set there would be standard lists of quantities, of materials required, and also standards for bridges, street signs, signals, etc., and every detail could be worked out to the highest perfection. National standards of this kind will result in great economies and greatly facilitate the completion of a harmonious National Highway System.

These standard plans should be given with proper instructions to all the street building authorities and every new road no matter how long or important should be a new well fitting link to the whole National Highway System. Then when a new road is to be built, the only question would be which Standards, A-B-C-etc., should be adopted. As soon as this is decided every other detail is at hand without depending upon the ability or fancies of the individual resident highway engineer.

This "Standardization" of the Highway Systems would be of the same importance and of the same advantage as standard gauge, standard rules, and standard signals are to our railroads. The standardization of the German Highways has surely resulted in tremendous savings in every detail of the work.

MAINTENANCE.—Fully equal in importance to the building of good roads is the proper maintenance of the same. Very unfortunately, however, this point has been given very little attention and only scant consideration in this country.

The common belief, in America, at the present time seems to be that when a road is built it is completed and it should be repaired only whenever necessity demands This is entirely wrong.

A public street or highway is subject to the influence of the elements, to heavy wear and tear and will soon become worthless if not carefully maintained. I know from long personal experience that a proper system of maintenance is of greatest importance and its neglect is of more harm than even serious mistakes and errors in construction. A street can be very cheaply and even poorly built and yet be of good service if properly maintained while the most expensive highway system will rapidly deteriorate if left to its fate.

Highway maintenance must, of necessity, be done very systematically and it is largely a matter of efficient organization in order to get satisfactory results.

The underlying principle of the maintenance organization must be not only to repair the roads but first of all to prevent such repairs. Therefore systematic maintenance must start at once with the completion of the street.

The first two or three years are the hardest on any new highway for the obvious reason that the whole street has to compact itself under traffic. Embankments have to settle, the loose dirt fills the drains and culverts and the whole surrounding territory has to adjust itself to the new conditions.

If a new highway is carefully observed during the first few seasons the cost of repairs will always be very moderate. If, however, this close observation of the new road is neglected costly repairs will be necessary often in only a few months after completion.

One stitch in time saves nine is an old and very true saying; this will never find a better demonstration than in highway maintenance.

Under a thorough and efficient system of maintenance our roads will never deteriorate but become better with age as has been demonstrated on the splendid old highways in Germany and some other European countries.

ORGANIZATION THOROUGH—Highway maintenance work in Germany, like everything else, is thoroughly organized. All public highways are divided into sections of from five to nine miles. For every section there is a guard who has to walk over the same at least three times a week and who is provided with wheelbarrow, shovel, pick and broom, which he usually carries along on his walks. His duties are to keep the street free from all obstacles, to see that all drains, culverts, and bridges are free from obstructions and that the road laws are enforced. Each guard must report once a week to his superior about his activities and the conditions of the road. Once every month he has to make a special report regarding the conditions of the road accessories as drains, signs, trees, signals, and bench marks; also boundary, stones, fences, etc.

The guard must immediately make all such small repairs as he can with his equipment. In emergency cases he has a right to hire such additional help as will be necessary to protect life and property.

If, for instance, a heavy storm or flood endangers the highway he has authority to hire all the help he needs to protect his road and to make such emergency repairs as are needed to keep his section in working order.

His principal duty is to prevent damage and repairs. A loose pebble is apt to cause considerable trouble if it is left on the road. It may pierce the street surface a good many times each day under passing loads. Loose twigs or weeds in the ditches are easily removed, yet if this is neglected there is danger that drains and culverts are blocked by the same and heavy washouts are inevitable. If a soft place or rough spot is at once covered with gravel, stone dust or screenings, accidents and costly repairs are easily prevented.

These guards are also an important factor in keeping the road laws enforced and although they do not need to give this any amount of special attention their presence alone is mostly enough to prevent disobedience.

The road laws of Germany are wonderfully simple, however, very effective, and rigidly enforced. At a later time I hope to have a chance to present a paper giving the principal points of the same.

There are practically no speed limits except in cities and villages, and yet road accidents are very scarce.

Every guard must live close to his road section and in some places a guardhouse with garden plot is furnished as part of his compensation. The work is light and pleasant and is done in healthy surroundings and, therefore, mostly elderly men and even invalids are taken for this work. Their pay is comparatively small, yet these men are reliable and very valuable public servants which stand in high esteem in their localities.

The guards are working under the supervision of road inspectors who have road districts of as much as 250 miles under their control.

Each road district is equipped with one or more complete outfits for heavy repairs including steam roller and other machinery. The inspector is in charge of this equipment and has also control over such quarries, stone crushing plants, nurseries, and other properties which are within his district.

He receives and tabulates all the reports from his guards and other employees and he is responisble for the up-keep and expenditures of the entire district.

These road inspectors are men who have practical construction experience, technical training and executive ability. They must make certain specified personal inspections of all of their roads and stand under the direct control of the State Highway Maintenance Corps, which is under the management of the Chief Engineer who is in charge of the whole highway system of his province or state. He frequently is also the chief of some other executive department.

These are the general outlines of the German System of Highway Maintenance, which has been developed through centuries and has proven to be of immense value even in the most trying times when the movement of large armies, floods and other calamities have taxed the highway systems to their utmost capacity.

It would be of no value here to go into further details and owing to the limited space at my command it would also be impossible to even outline the subdivisions of the work and the practices which have been adopted to meet the special requirements of the different parts of valley and mountain roads. Every season of the year must be utilized to best advantage and the agricultural and labor conditions are also important factors in road maintenance work.

SYSTEM OF HIGHWAY MAINTENANCE—Based upon my European experience and my knowledge of American conditions I will, in the following lines, endeavor to outline a general plan for American Highway Maintenance Work.

The first principle of Highway Maintenance must always be to *prevent* repairs as far as possible. Such repairs as become necessary must be attended to without undue delay and must be made after a well organized plan in the most economical and efficient manner. In order to accomplish this it is necessary that every part of the road system is continuously kept under close observation. Therefore, the first requirement is a division of the whole system into sections, each of which is placed under the care of a guard.

The length of each individual section is, of course, depending upon the condition of the road, whether located in valley or mountain districts, and also upon the amount of traffic which the road carries. It is impossible to give any hard and fast rules which can be followed in every instance; however, I have found that a guard will be able to walk about one and one-fourth miles per hour, and this will give him sufficient time to closely observe the conditions of his road and to remove such small obstacles which he can handle without additional help. Based on an eight-hour

working day, this would allow the close inspection of 10 miles per day .

INSPECTON.—This inspection should be made at least twice every week and therefore 30 miles could be controlled by each guard if he had no other obligations. However, every guard must make small repairs and it can safely be estimated that one-third of his time will be taken up by such repair work. Then again, if reasonable allowance is made for going and coming and for other delay it will be found that the average section could be about 15 miles in length.

For roads with heavy traffic and in populated districts, especially if numerous bridges, culverts and drains are present, it may be found that only five miles will be all that one man can properly attend to, while in long, level lines with light traffic and where the road is in first-class order, sections of 20 or more miles could easily be handled.

The division of the whole sytsem into sections requires, therefore, a good deal of experience and foresight and it will need careful watching and occasional changes before definite divisions can be decided upon.

REPAIR WORK.—Every guard receives a set of tools, complete instructions and report cards which he must use intelligently. He must always walk while he is doing his inspection work. He must also carry such small tools as are necessary for light repairs. Only in walking his section will he be able to properly perform his duties. A man on a bicycle or any other vehicle will usually not stop to remove a loose pebble or some weeds, and just these small matters need careful observation and attendance.

ROAD GUARDS.—The guards are best recruited from the laboring classes and there is a splendid chance for the state to give employment to older men and even cripples. These men will usually take great pride in their work and soon know every blade of grass along their section. They can mostly be well depended upon and will appreciate the opportunity to have a fair and steady income. I have observed street guards over 80 years old who performed their duties much better than most young men. There are plenty of such men in every community which otherwise might be a burden to the state and who can be transformed into valuable, faithful state servants.

It should be understood by every member of the organization that a guard is kept in service, and not shifted to another location as long as he performs his duties. This will give great stability to the whole maintenance organization and greatly reduce the cost of operation.

INSPECTORS.—From 25 to 40 sections are to be united into a road maintenance district in charge of an inspector who should be a man of practical experience and some technical education. His duties are to make regular inspections of his district and to form the connecting link between the section guards and the Chief Engineer who is in charge of the entire system and through the Highway Maintenance Commission and is directly responsible to his state.

Each inspector is located close to the center of his district; he is supplied with a suitable office, secretary, automobile and such other equipment as he needs in the performance of his duties.

He receives the daily reports from the guards and he reports at regular intervals to the Chief Engineer to whom he also must make all his requests for materials, machinery and labor for the necessary repairs. He is responsible for the repair crews while working in his district and also for the supply stations which are located within his jurisdiction. He should have authority to do emergency repairs in case of sudden serious disturbances.

EXECUTIVE OFFICER.—The executive head of the entire Maintenance Organization of each State should be a Chief Engineer who through his District Inspectors is kept in close touch with every detail of the entire road system. He has direct charge of all State Highways and is, of course, provided with all such help and equipment as he needs for the performance of his work.

He must make a reasonably close advance estimate of the cost of the whole organization and after the necessary appropriations have been made, he should be responsible for all expenditures and for the conditions of the Public Highways in his State.

The Engineer's office should be located in a principal city which is also to be the operative center for all the repair work. All requests, reports, purchasing and accounting is made from this executive office.

ORGANIZATION. — How the repair crews are organized and whether they will radiate and work from a common center, or whether several repair districts are separately maintained must, of course, be decided for every State after a careful study of the whole problem. The geographical form and location of the State, the distribution of the main arteries of travel and the physical condition of the highway system are the deciding factors.

Wherever possible one centrally located yard where all machinery and tools, repair shops, and other equipment are kept and maintained will be the most desirable. The whole system is then at all times under better control and duplication of equipment and an expensive organization can thus be avoided.

Especially at the present time, using automobile work-trains, a very flexible mechanism is available and such a central system is of greatest value. Modern road repair machinery can be quickly transported by its own power over long distances and the program for a season's work can usually be made so that regular circuits are covered and waste of time for transportation almost entirely eliminated.

For repair materials, supply stations are formed in every district at such points which prove to be most desirable from a transportation standpoint.

These are, of course, only general outlines and suggestions for a Highway Maintenance System. There are numerous details to be carefully considered which must be decided to meet existing conditions. The organization of such a plan requires experience, a great amount of executive ability, tact and patience.

In order to serve its purpose best the whole system must be trained to accomplish its work quietly with rapidity, efficiency and utmost economy.

Road construction and road maintenance are two entirely different problems, and therefore every State should have two separate organizations for its public highways. These two organizations should work in harmony and assist each other where possible, but they should be kept entirely separate in management and financially.

Only with systematic maintenance will our highways be able to perform the duties for which they are built and the money spent for this purpose in the right direction will bring valuable returns. Otherwise, even the best and most expensive highway system will soon deteriorate and fail.

How to Make Estimates—Suggestions for Saving Time and Money

There is no uniformity among engineers and contractors in making up estimates of cost for construction work. Each man follows, to a great extent, his own ideas, feeling that he is using the best method. Thus each has his own system, which is one reason why prices vary so much in many proposals made on the same job by different contractors. The factor of personal judgment will always show in making up estimates; but it now enters into this work much more than it should, as estimating should be made, and is susceptible of being made, a more exact science.

As evidence of this, the writer has seen several men following the same method make up estimates of cost that agreed very closely, within a few per cent, this difference being due to the personal judgment as to details, while these results could not have been obtained by widely different methods.

Low prices should not be made by close estimating, for this means a possible loss of money; but low prices should be made by liberal estimating and by improved methods of doing work and the installation of the best types of labor-saving machines.

Evidence of this is shown in another article in this issue on concrete sidewalks. Eight men by hand methods did so much work in a day, while the same number by improved methods could have done more work in the same time, while three men with the aid of a small concrete mixer did more work in one day than the eight men did. It is plain to be seen that the contractor on the last job, even with a poor estimating system, could have named lower prices for his work than the other contractor.

The great desideratum of any estimating system is accuracy. To land work by public bidding, prices must be low; but there must be a reasonable profit in them, and to insure this they must be accurate. This cannot be obtained by loose systems of estimating, but it can be done by a well thought-out system, one that takes into consideration every factor, all the conditions, and leaves nothing to be guessed at, nor to be covered by the so-called item of contingencies. Furthermore, each unit of work must be broken up into the smallest details possible, so that the estimate deals with small rather than large units. The value of this can readily be understood by an illustration. If the price on one unit is one dollar, and an error is made of ten per cent, the work may be done at a loss; but if this unit is broken up into ten or more items, then, if a mistake is made on any item, the total error will hardly amount to more than a cent, which would not materially affect the work.

These general remarks should be elucidated, and given more in detail. First, though, it is necessary to take up the subject that leads to scientific estimating, and that is cost-keeping. During the past five years cost-keeping has been discussed pro and con, but even those who have argued against it make some pretense at keeping costs. Estimating is dependent upon cost-keeping. Without cost-keeping estimating, unless based on cost figures kept by others, will be but little more than guessing.

If cost-keeping is done in lump sums then the estimating based upon such costs must be in lump sums. This shows the necessity of keeping detailed cost; and even then, if the cost records are to be of value they must be assembled and analyzed. If enough information is given with costs, any such records can be an-

(*Continued on page 41*)

Road Foundations

By HOWARD EGLESTON, New Orleans, La.*

The very interesting paper on "Bituminous Concrete Pavements," contributed by Mr. Spencer, and printed in the Journal for June, 1913, contains reference to the petrolithic system of road building that I would like to enlarge on, and, to some extent, correct.

John W. Fitzgerald was the man who, noticing that the passing of a flock of sheep over newly plowed ground made a hard roadway, set about making a machine that would serve the same purpose.

The first trial was made with a cylindrical log of wood into which he drove a large number of railroad spikes. Further experiments resulted in the adoption of a built-up cylinder, about three feet in diameter, on the outside of which are secured one hundred and fifty to one hundred and sixty-four "feet," which project nine inches from the surface and have a "sole" or bearing of four square inches. Two of these cylinders, each three feet in length, are mounted in a frame and form the petrolithic rolling tamper.

About the same time that Fitzgerald was experimenting with his machine some one noticed that the roads in the oil fields on which oil had been spilled by teamsters were changed from dusty and muddy streets to hard surfaced highways.

Consequently these two discoveries were hailed as the panacea for all bad roads, and, since oil was cheap, it was used plentifully, with the result that many "oil mud" roads were built all over California, by men who did not use either the tamper or the oil scientifically.

Fortunately the control of the Fitzgerald patent fell into the hands of men who appreciated its value when rightly used, and under their intelligent guidance it is in very wide use throughout California to compact the soil of the sub-base, and, in conjunction with the steam roller, to compact the stone surfacing when the latter is used. It has been found that the tamping roller will locate and break down soft spots that the regular road roller will pass over and leave.

The use of oil in the ground as quoted from specifications by Mr. Spencer has generally been abandoned except in cases of sandy or very porous soils, and it is now commonly used only in the top or wearing coat. The best results are attained by cultivating the ground after plowing, until it is uniformly fine and free from lumps. It must then be moistened so that it will pack most perfectly, and yet not be so wet as to stick to the feet of the tamping roller. Very much depends on the condition of the soil when the tamping is done, and many failures are attributed to the neglect of moistening the soil properly.

While the tamping is in progress it is necessary to follow the tamping roller constantly with a heavy cultivator, to keep the untamped ground loose and mellow so that it shall be uniformly compacted. The teeth of the cultivator are raised as the tamping proceeds, so that they will always be an inch above the compacted earth. If the soil has been made suitably fine, moistened properly, and kept stirred by the cultivator while the tamping is done, the result will be a foundation of dirt into which it will be impossible to drive an oak stake, difficult to break up with a sharp pick and which has no "soft spots."

On a properly constructed foundation as described above, any kind of a wearing surface can be placed. For lightly traveled roads a sprinkling of gravel or broken stone, rolled into the surface, will make an excellent road; for heavily traveled roads, an asphalt macadam or concrete surfacing, four or five inches thick, may be used. When the foundation is uniformly compacted, as it is by the tamping roller, the necessity of having the concrete sufficiently thick to "bridge over" the soft spots, is removed, and a great saving in the cost of concrete can be safely effected.

In rebuilding the famous Huntington Drive that connects Los Angeles and Pasadena, over which constantly passes a tremendous traffic, Mr. Joyner, the County Highway Engineer, used only five inches of concrete on a tamped base, covering the concrete with a coating of heavy asphaltic oil on which is placed a sufficient quantity of stone screenings to absorb the oil. The result has been most satisfactory, and has proved very economical.

The same form of pavement is being very generally specified for the magnificent system of State Highways that are now being constructed in California.

In El Paso, Texas, the tamping roller has been used for four years in building residential streets and boulevards, and in Louisiana the Louisiana Petrolithic Construction Company has been for a year engaged on extensive road building contracts in that State.

As stated before the early practice of using oil in the earth base has been generally abandoned except in soils which require a binder, but the oil is used as a binder in the surface coat, and for the purpose of waterproofing the road.

In the early days of the use of oil it was not clearly understood that it was not the oil, but the asphalt contained in the oil, that was of value to the road, and a great quantity of valueless oil was used. Unless the oil carries a large percentage of bitumen of the right quality it is pretty nearly a waste of money to use it. Road oils that derive their bitumen from the refuse of the oil refineries are of very little value, and in many cases a positive harm to the roads.

That California has such a magnificent system of oiled roads is due largely to the fact that the California oils have an asphaltic base, and contain a very high percentage of bitumen. Therefore, instead of their road oils beng enriched by the bitumen extracted from petroleum oils when refined, some of them carry naturally over 70 per cent of bitumen.

When this oil is placed on a road the thinner oil soon evaporates, or is absorbed in the earth, leaving only the pure asphalt to act as a binder and waterproofing. There are petrolithic built oiled roads in California that have been in constant use for six to eight years without any repairs found necessary.

The petrolithic system of road building is not a patented pavement as is commonly believed, but rather a system of foundation building for any kind of a pavement. Its great value lies in using the earth to form a foundation, instead of bringing to the road more or less costly foreign material, as stone or concrete, and completing the road with a comparatively light metalling.

In the case of most kinds of pavements, such as asphalt, brick or wood block, when the sub-base has been properly compacted by use of the tamping roller, a much lighter concrete base can be safely specified, a saving of three to four inches in thickness being quite possible. Under most circumstances this will mean a saving in cost of from thirty to forty-five cents a square yard.

*Member of the Society.

How to Make Estimates— Suggestions for Saving Time and Money

(*Continued from page 40*)

alyzed, even printed cost data; but one great defect of most costs, both printed and unprinted, is that not enough details are given to admit of analysis. Cost data that cannot be analyzed have little value, save for being used as checks on estimates, and even for this purpose their value is questionable.

Cost data should be kept in great detail for two excellent reasons. One is to locate wastes and excessive costs and by comparisons know them, and thus eliminate them promptly. The other is to have such details of costs that estimates can be made up in the same detail. The two should be bound together, and the two systems should be based one upon the other. This is not a new theory, but unfortunately few contractors and engineers see the connection between the two systems, consequently most cost-keeping systems are not devised to give much assistance in estimating.—*The Contractor.*

The Contented Contractor

The man that is content with his present position, has a faulty equipment in the head. The business man that gets satisfaction out of the fact that he is beating the blunderings of his forefathers, will some day see the procession of posterity pass him.

The contractor who does not add one advantage to his position each day, forfeits one chance in competition.

The contractor who fails to look up leaks, stop losses and get in close touch with his machinery and his men, is sleeping at the switch.

As a business man, you can get insured against almost any kind of a calamity, save the calamity of contentment that comes from over-confidence.

You may be smart, but bind this fact on your forehead—there is a new crop of competitors coming on every season—smart ones, too.

Wake up and wake up everybody about you. Hire and fire until you get a loyal, efficient organization. Keep up your enthusiasm and keep up the enthusiasm about you. Business is a battle, and on your own courage, on your own confidence, depend the confidence and courage of your men. They are looking to you to be leader—be one.—*The Mixer.*

BRANCHES

Trenton

Mr. Ludwig S. Filbert was appointed temporary secretary of the Trenton Branch and we look forward to a powerful representation as a result of his efforts.

Philadelphia Branch

The first meeting for organization was held in the rooms of the Engineers' Club of Philadelphia, February 21st.

On Saturday, March 14th, the Philadelphia members met at 1317 Spruce Street, and after dinner, with Mr. Oliver R. Parry in the chair, the Constitution and By-Laws of the Philadelphia Branch of the American Society of Engineering Contractors were adopted. Oliver R. Parry was elected chairman; Major Cassius E. Gillette, vice-chairman; T. Hugh Boorman, secretary, and James Kelly, treasurer.

Among those present were Oliver R. Parry, J. Walter May, T. Hugh Boorman, F. V. Warren, Manton E. Hibbs, John C. Troutwine, Cassius E. Gillette, James Kelly, Geo. D. Steele, W. A. McIntyre, C. Burke Filbert, Jos. G. Rock, Richard Gulpin, Henry L. McMillan, J. Russell Wilson, Halbert P. Gillette.

Joint meeting of The American Society of Engineering Contractors and the Engineers' Club of Philadelphia is expected to be held in the early fall.

Obituary

William A. Hunicke, who was chief engineer of the Louisiana and North West Railroad Co., a resident of St. Louis, Mo., and a member of this Society, deceased Monday morning, March 9, 1914, at the fire of the Missouri Athletic Club, St. Louis, Mo.

Resolution presented in behalf of John A. Yates, civil engineer, 1 Broadway, New York, and adopted at the meeting of the Board of Direction on March 26th:

"Whereas it has pleased Almighty God to remove from among us and take to His eternal rest on March 25th, 1914, Pierre Proal Hurlbut.

Be it Resolved, That the Board of Directors of the American Society of Engineering Contractors extend to his bereaved family their deepest sympathy in their loss and wish to express their belief that his well spent life as youthful soldier, gentle and loving but brave character and his work as a civil and U. S. Government engineer with his strong Christian personality will leave and impress this generation and on those yet to come.

"Be it further Resolved, That the president be requested to appoint a committee to attend the funeral services in St. Paul's Church, Newark, N. J., on the 27th inst., at 2:30 P. M."

A committee of three was appointed by the president to attend the funeral services held in St. Paul's Church, Newark, N. J., on the 27th inst., at 2:30 P. M., consisting of General W. H. Bixby, Major Cassius E. Gillette, and Mr. T. Hugh Boorman.

ENGINEERING LAW

Edited by THOMAS H. RAY *
of the New York Bar

The Engineers' and Mechanics' Lien Law

The necessity for a statute providing for mechanics' liens arises out of a distinction which the law makes between real property and personal property. The operation of the rule of law which transfers all fixtures to the owner of the land makes the performance of labor or the furnishing of materials for these improvements become a business risk on the part of those who engage in it which is quite different from that assumed by the merchant who sells goods out of his stock in trade or by the mechanic who performs labor upon a chattel entrusted to him for that purpose. The merchant may protect himself upon a breach of the contract by either suing to recover his goods by replevin or by issuing execution after securing judgment against the purchaser thereof. Likewise, the mechanic who works upon a chattel can demand his compensation before returning the chattel upon which he has been working.

The material man or laborer who has furnished materials or who has, with such materials, built a house or other improvement upon the land of another has no claim against the owner of the land outside of that which is given him by the lien law, for the reason that his labor and materials have gone into and become part of the real estate and are conveyed with the land upon a sale by the owner of the land.

To remedy this, to give such material man or laborer something like the protection which the very movableness of chattels gives to those who deal in chattels, has been the design of the framers of all mechanics' lien laws. The problem, of course, is greatly complicated by the lack of privity between the owner and the material man or laborer, and the effort to protect the one without unduly burdening the other must always continue a problem.

Real estate differs from personal property in that it cannot be conveyed by delivery of the land itself. The law has devised a constructive delivery by which title to property is passed by the giving of a written document called a "Deed," which is recorded in a designated office, and the recording of which signifies the change of title to the real estate. Likewise, if a man wishes to borrow money on real estate he recognizes the claim of the lender by giving to him a written document called a "Mortgage" admitting the claim of the lender against the land and this mortgage is also recorded in the office designated and the mortgagee's claim is thereby made a matter of record. If a mechanic or material man is to be given a claim against real property it must therefore be given in the form of the right to file a written claim against the real estate and under all mechanics' lien laws such a right is given. The person filing a lien, therefore, has no right, except such as are directly given to him by the lien law. The right to file a mechanics' lien is usually given to cover labor performed in the improvement of real estate and materials furnished for the improvement of the same.

Liens for Architects' and Engineers' Services

It has been generally held that the term "Labor" includes skilled as well as unskilled labor and the statute protects all persons who perform labor, and includes the services of one who directs and applies the labor of others. In a recent case in New York the rights of architects and engineers to file liens was set forth as follows:

> "The general rule to be deduced from the adjudicated cases is that, while an architect is not entitled to a mechanics' lien for drawing plans alone, yet, when he both draws plans and superintends construction, he is entitled to a lien for the value of both plans and superintendence. An architect who makes the plans and supervises the erection of a building is within the words and reason of the law.
>
> "The rule above stated is well illustrated by Rinn v. Electric Power Company, 3 A. D. 305, 38 N. Y. Supp. 345. In that case the architect had drawn plans for a large building, of which, however, only one-half had been erected under his superintendence. He was allowed a lien, in addition to his fees for superintendence, for one-half of the value of the plans which he had prepared for the whole building; the court remarking that an architect cannot have a lien for making plans alone, but, when he makes the plans and supervises the construction, 'it is the part that the architect takes during the construction that draws his services within the lien law.' In Thompson-Starrett Co. v. Brooklyn Heights Realty Co., 111 A. D. 358,98 N. Y. Supp. 128, the plaintiff was denied a lien for preparing plans because no building was erected. In the present case the plaintiff not only drew plans, but superintended the construction."

Likewise, a contractor is not entitled to a lien for the service of an engineer in making an examination of a site preparatory to the drawing of plans where the contract was immediately thereafter breached by the owner and the plans were never used and no construction work was done.

Tools and Machinery Leased

No lien is usually allowed for the rent of tools such as a steam shovel which is used in the improvement but which does not itself enter into the improvement. The lien is only given for material used and material is defined as meaning "Matter which is intended to be used in the creation of a mechanical structure."

*Member of the Society.

Coal and Explosives

It has recently been held that while dynamite and other explosives are materials within the meaning of the statutes providing for mechanics' liens for the supplying of which a lien may be acquired, coal and oil which are supplied to a contractor for the purpose of operating his steam boilers in conjunction with the carrying on of a job for the improvement of real estate are not materials, and no lien can be acquired for the latter.

In a recent case in New York the court distinguished between these two kinds of cases and used the following language:

"The dynamite was applied directly to the earth which had to be removed so that the structure might be completed as planned. The removal of the earth was an essential part of the construction. The dynamite was furnished and used to effect, in part, by its direct action that construction and entered wholly into it. The construction primarily, and not mediately, absorbed and included it. It and the substruction took the place of the earth stances which in the process of conit released entered into the construction in the same sense and with the same reality although it did not remain a visible part of the completed improvement.

"It was not thus with the steam shovel. It, as an article or substance, was not applied to the construction, upon the completion of which it remained substantially as it was at the beginning and ready to be taken to and used upon another undertaking. Its effects, and not it, were applied directly to the construction, which did not absorb or include it. It did not lose its identity nor cease to exist as a separate article. It promoted and aided it, but was not a material furnished for the construction. The distinction we are here expressing was made clear by our decisions already mentioned.

"Was the coal used to operate the steam rollers and traction engines to be considered as an adjunct to those machines or as materials furnished for the construction of the highway? While the Lien Law, which should receive a liberal, it should not be given a forced and unnatural construction or be extended to a state of facts not fairly within its general scope. The facts underlying the decision that the furnishing of the dynamite upheld a lien for its cost do not exist as to the coal furnished in this case. It was applied to the machines and not directly to the highway, and they and not it absorbed it."

Grading and Demolition of Buildings

On the same theory as that which denies to an architect the right to a lien in cases where he does not supervise the construction of a building no lien is generally awarded to an engineer or contractor for the grading of real property unless the grading is done in connection with the permanent improvement of the property. Likewise, in the case of the demolition of an old building, since the property is not permanently improved by the demolition of the building no lien is awarded for the work in connection therewith.

ACCOUNTING DEPARTMENT

Conducted by **HARRY M. SMITH,***
Certified Public Accountant, New York

Mr. Wm. B. King, member of the Society, in a recent communication included a brief outline of certain legal proceedings that had been brought to his attention in connection with the affairs of a large contracting concern. He is of the opinion that the points involved are of considerable importance to those engaged in the contracting business and that possibly some good might result from a discussion of the matter. It was his view that the case illustrated one of the most serious difficulties in the accounting systems employed by many contractors, and further, that it was of the utmost importance that any such accounting system should actually reflect the facts as they exist; otherwise the accounts would be incorrectly stated. It may be well to remember that the contractor referred to in this particular instance was "a company doing a large business, presided over by a man of very wide experience and of unusual judgment."

Matters of this kind are undoubtedly along the educational lines that the Society is working, therefore the following is quoted from his communication:

"In a recent law suit it was necessary in preparing the original complaint to fix the damages arising from the continuation over an unexpected season of an engineering contract, involving a large plant. The contractor made an estimate and stated it as $10,533.23. This amount was included in the complaint, the figures of the contractor being accepted by his counsel as a complete statement of the loss, sufficient for the presentation of the case.

"When testimony in the case was taken, it was disclosed that the contractor had overlooked many sources of loss arising from overhead expenses due to the continuance of the contract for a year. These were all figured out with care, in the light of the disclosures of the testimony, and the total amount reached, upon careful consideration as a cost of carrying over the work for one year, was $38,124.34. The complaint was accordingly amended and an effort will be made to secure judgment for the full amount now claimed."

It is obvious that any accounting system that does not place the results of a particular contract more accurately than this, can hardly be dignified as a system. Bookkeeping is, or should be a systematic recording of business transactions. In order that an intelligent idea may be obtained of what has been accomplished during a certain period, it is necessary that the facts should be recorded properly and so grouped, as to reflect the business conditions as they have actually existed. A well designed system tends toward such a result, but mere system of itself will not accomplish all that may be desired. It is also necessary to study the results as presented by the system and then, by analyses, comparisons, percentages, etc., determine their accuracy and dependability. As statesmen are guided along certain lines in their efforts to avoid serious errors, by their study of the history of the other and older nations, so should the business executive profit by a study of the history of his own or of other similar enterprises. That history is recorded in the cost records and books of account. Should there be sufficient data available, he can readily enough determine within reason, the accuracy of the results of a particular transaction, or group of transactions.

Now as to the case under discussion, there was, it would appear, not only a lack of proper system, but also a complete absence of studying the results that were obtained. The system employed may have been inadequate and weak, but surely there was something radically wrong "higher up," when the responsible parties failed to detect such a great discrepancy when the figures were submitted. Suppose there had been no suit in this particular instance and that an estimate for another job had later been prepared from the original figures given.

This Society judging by this case, has undertaken "some job" in endeavoring to establish uniform systems of cost accounting that will eliminate the guess work method of submitting bids.

However, the condition of guessing at costs which results so frequently in underestimating, is not peculiar to the engineering contractor. Factories, trading concerns, department stores, combining as they frequently do, manufacturing as well as trading, are in a majority of cases, it may be conservatively stated, conducted in the same haphazard manner—they discuss costs with a superior air or wisdom, but comparatively few have even a half-way knowledge of the real costs.

But as to the case in hand, wherein lies the remedy for such appalling conditions as existed in this striking example? The answer is, in just the work this Society has been and is now doing. It may be truly said after reading, even in a cursory manner in the Society's Journal, the many excellent papers that have been written by members that the best thought of an enlightened profession is being given freely for the benefit of just such cases as the one under discussion. Special reference in this particular case may be made to the issue of January, 1910, which contained the folowing:

"Uniform Cost Keeping Systems"
GUSTAV KAUFMAN

"Report on Cost Analysis with Notes on Sewer Construction"
DEWITT V. MOORE

These articles should prove interesting to anyone interested in the subject of costs. The writers, because of their experience, are in a position to speak with authority on such matters.

The importance of the adoption by every contractor of a uniform system of accounting that embraces a fairly accurate system of cost keeping cannot be too strongly emphasized. Cost records are necessarily a part of comprehensive accounting system and the two should be embodied in one system. The accounting of any enterprise,

* Asso. Member of the Society.

whatever its nature, may be made to stand on its own feet, but the costs, to be dependable, should absolutely be controlled by and closely related to the accounting. This latter statement does not agree with the expressed views of certain engineers, but the fact remains as a matter of experience, that where attempts have been made to operate the two systems independently, that many important items were not recorded on the cost sheets. There can be no assurance that the cost records, even those covering direct charges, are complete, if they are kept simply as memoranda.

However in one feature of the contract under discussion, it is very evident that proper consideration had not been given to a very important point and that was the extended period of time involved. In engineering contracting this is not an unusual condition. It is, however, a condition that depends considerably upon the weather and that necessarily involves the inclusion of a larger percentage of general overhead costs. It does not seem possible that the discrepancy existing between the amounts, as stated in the original and in the amended complaints, could have been due entirely to overhead expenses, but as the facts are recited in Mr. King's communication, such would appear to be the case. It was stated that the corporation was a large one and implied that a number of high salaried officers and office men were employed; obviously the overhead would be heavy.

At any rate, assuming that the amount by which the complaint was amended was, because of the existing conditions, due to the overhead, what items from a theoretical standpoint should have been considered? Again, how should such items have been treated that they would have been properly applied on the cost records.

Mr. Kaufman, in his excellent article, states the "General Expense" or "Administration Account" items to be as follows:

1. Engineering.
2. Bookkeeper, Stenographer.
3. Timekeeper, Storekeeper.
4. Telephone, Stationery, Sundries.
5. Rentals.
6. Legal Expenses.
7. Surety Bond.
8. Liability Insurance.
9. Watchman.
10. Interest and Discount.

The sequence in which the items of this group are stated is not material; the important point is that all such shall be included. Printed forms that indicate within reason, every possible item of expense that may be incurred in the business, should aid materially in having them properly included.

Practically every item shown by Mr. Kaufman could be in the nature of a direct charge to a job and all such expenses necessarily arise in connection with certain contracts. Obviously they should be charged as "Direct Expenses" and be included in the costs as such. Then again, the same items may also arise in the branch or general offices of a concern, in the conducting of the business on the whole and as such would be indirect expenses; they cannot be applied direct to any job in particular, but must be spread over all the work in process during the period in which such expenses are incurred.

It is reasonable to state that the General Expenses of a branch office should be applied to the jobs originating in and handled by a particular office; in addition to which perhaps a certain percentage of the Administration Expenses of the general office should be considered. The latter, however, would depend upon the plan under which an organization is conducted. One concern may be satisfied to permit the branch offices to stand upon their own feet, not apportioning the expenses of the general offices over all; another may prefer to charge a fixed sum to branches as their proportion of general office expense. In any event whatever the plan, how are such items to be treated, assuming that but one office is maintained?

First of all, the following items and certain others at times may be added to Mr. Kaufman's schedule:

Insurance.
Taxes.

Deterioration of general plant.

Interest upon investment in general plant, as well as interest on percentages of amounts that are retained until completion of work; this perhaps was included as Item No. 10, but it is desired to note it particularly; certain contractors, perhaps, may not consider that interest upon investment is material; the fact remains, however, that a similar sum well invested, would yield an income and it is but fair to the capital invested to expect a return for its use.

Salaries of general office and of officials, or if a firm, allowance for services of members which obviously would be on an arbitrary basis.

The basis upon which Administration or General Expenses are to be apportioned brings up the point, that whatever method is determined upon must be adhered to afterwards in order to preserve the value of comparative results or for preparing other and later estimates. Having determined the amount of all the Indirect Expenses, it is recommended that they be apportioned on the basis of Direct Labor. Jobs will vary greatly in the proportions of Direct and Indirect Labor, Materials and Expenses, but experience has shown that of these that Direct Labor is the logical basis in cost accounting for the apportioning the Indirect Expenses or General Overhead.

Mr. DeWitt V. Moore, as already stated, has written a very complete paper, "Report on Cost Analysis with Notes on Sewer Construction," which may profitably be read by any one interested in Cost Accounting. He covered fully the point under discussion and stated "that as labor is a fair indication of the amount and character of the work done and unless the rate of pay, or the class of labor, is extraordinary, that jobs may be directed compared on this basis." He recommended, therefore, the appointment of expenses on the basis of labor.

According to Mr. Kaufman, the Overhead Expenses should be apportioned and spread over the sub-divisions of a contract such as excavating, concrete, masonry, due regard being paid to the relation that the amount of each bears to the entire amount of the contract. In many respects, the suggestion is a good one, as it permits not only of a closer study of the final results, disclosing where the weakness of the estimating exists, but it also affords data that should be invaluable for future estimating. May it be said that to err in estimating is expected (of a contractor), but to produce an actual profit is shocking (also to a contractor).

When it is the practice of a concern to close the books annually or more often it is not a difficult matter to dispose of such contracts as have been completed within the period, charging them with the direct costs and with the proper percentage of general expenses based on direct labor. But what is to be done with contracts that may extend into the next or perhaps into several fiscal periods? Most assuredly they should they extend. Againevery period into which bear their proportion of the overhead of how are they to be priced in closing the books? Should they be carried at cost or should each period be credited with a portion of the profit for the work done within the period?

A certain contract may provide for a fixed sum for the work in its entirety or perhaps for payment on a basis of actual cost plus an agreed percentage of profit thereon. It is fair to assume that as the construction work is usually being inspected, as it progresses, on behalf of the parties for whom it is being done, that it will finally be accepted when completed. This may not be true in certain classes of construction, such as boat building, where material, class of work on frame of vessel, type of engines, etc., has been passed by the inspectors and yet the vessel on its trial trip will not produce the required speed and as a consequence, serious penalties will be imposed and perhaps a loss realized on the contract.

On contracts such as excavating, concrete or masonry, where the periodical measurements for estimates on which partial payments are based, there may be obtained sufficient data on which to base a reasonably accurate estimate of the value of the work that has been completed. It is well, however, to be conservative and not anticipate profits when such contracts extend into another period. Therefore in pricing the completed work at the end of a fiscal period, unless, after allowing a reasonable margin for contingencies, there still appears to be a profit accrued on the work done, it is better to state it at cost, not adding any profit for the period.

On the other hand, another uncompleted contract may because of the unexpected conditions appear to be a losing venture. That should be taken over at the full amount of the contract, after deducting the amount estimated as necessary to be complete. It would not be fair to consider it as worth even its cost as that will not be realized.

In cases where the amount of the contract is cost plus a certain percentage, there can be no objection to adding to the cost the accrued profits for the period and so ascertain the value of the work completed.

Having valued all uncompleted contracts, each considered on its own basis and having carried the balances forward as applying to the new period, it is then possible to close the books for the period, applying the overhead expenses as already noted. Obviously all items of expense, whether direct or indirect, should be cared for and applied properly to the various contracts. This being done, it does not seem possible that a great discrepancy, such as resulted in the contract that has been under discussion could arise.

Public to Private Employ

The engineer of sewers of a western city has resigned his position and has accepted a job with a contractor at three times the salary he received from the municipality. The commissioner of street cleaning of an eastern city, retired from office as the result of the election of a new mayor, was at once gobbled up by a contractor who had charge of cleaning the streets in a nearby city. As contractor's representative he receives $2,000 a year more than he did as a public official.

EMPLOYMENT BUREAU

Men Available

Actuated by a desire to be of direct assistance to all of its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

003 Junior member of this Society, twenty-three years old, single. Education at Stevens' Institute of Technology, Mechanical and Electrical Engineering. Present position as chief operator in sub-station of an electric railway and light company. Has been employed with three large corporations in the following capacities: Assistant to engineer of tests, start and run tests on boilers, turbines, generators, engines, pumps, etc. Responsible for results. Inspection and analysis of efficiency; able to operate switchboard, put in turbines, etc. Cadet engineer, laying gas mains, erecting pole lines, keeping records of meters, transformers, lamps, etc. Generator tender and switchboard operator. Record A-1.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

006 Superintendent with twenty years' experience in heavy construction operations, competent to handle large jobs successfully. Good reorganizer, now open for engagement. Considered a hustler. Any location. Age 43. Practical experience in installation and operation of cableways, shovel, pile-driving and such apparatus. Member of the Society.

007. A neat little organization with $2,000 to invest, consisting of a competent ESTIMATOR, with four years' successful record (Member of the Society) and a superintendent mason, and a carpenter with four years success in handling concrete work, desire association with an experienced contractor with sufficient financial resources Write to the Secretary for further particulars.

The Yesbut

There are plenty of Yesbut men in this country—men who greet a new plan, new idea, or a new proposition, with a sickly smile, with a frigid hand-shake of doubt, fear and hesitation. Ever since the Stone Age, they have been on the tail end of the procession of progress.

There are plenty of contractors who refuse to listen, who refuse to try-it-out, who refuse to consider better ways and better means—plenty of contractors who are doing their work as the work was done ten years ago; and this is a libel on progress, on genius—a mighty expensive bit of stubbornness, indifference, or whatever-you-want-to-call-it.

The contractor who can meet competition to-day, is the try-it-out man, is the forty-horsepower, resourceful man, whose enthusiasm is 110 in the shade.

The contractor that is ahead to-day is the man that will listen when you talk of some machine that will save time and labor. The Try-it-out man has the gumption, the grit, and the go-ahead material, all of which are necessary ingredients in the receipt for success.—*The Mixer.*

96,000 Bricks Laid in a Single Day

In the laying of the brick floor of the completed portion of the quay wall at the Balboa terminals, a squad of five West Indian masons, serving in relays, three men working at the same time, with two resting in reserve, laid in one day of ten working hours, a total of 96,000 bricks. The entire gang, including the white foreman, Mr. Park T. Andrew, and the men engaged in handling the bricks from the cars, mixing and carrying mortar, etc., consisted of 67 men.

The masons laid the paving between the inner rail of the track along the face of the wharf and the inner coping, a width of 50 feet, over a distance of over 400 feet, covering an area of approximately 20,000 square feet. Counting five men in the squad, each laid at the rate of 1,920 bricks per hour, or 32 per minute; three men being actually at work, the bricks were laid at the rate of 3,200 per man per hour, or 53.33 by each man each minute. The masons were paid 13 cents per hour.—*Canal Record.*

Report of Standing Committee Upon Quantity Surveying

The Quantity Surveying Committee recently reported to the San Francisco Chapter, A. I. A., as follows:

First—That in our opinion the present method of estimating the cost of buildings, taking figures and the letting of contracts is crude and inefficient. It is not only unadapted to modern work, in view of the immense progress of recent years in construction, materials and constructive methods, but the figuring practices of today (and which many architects condone and encourage) are now generally admitted to be inaccurate and conducive to enormous waste of time and energy, uncertainties, difficulties, disputes, liens and even suits at law.

Further, present estimating methods are also undoubtdely largely responsible for embarrassing situations arising from unsatisfactory work, and delays, etc., quite apart from the gambling methods thereby encouraged, and which are injurious to the best interests of all concerned. These same methods promote and encourage certain objectionable practices in contracting, such as peddling of bids and similar juggling of figures to recoup either actual or anticipated losses on contract work.

Second—We submit that most of the difficulties which architects experience in carrying out work, arise not from a contractor's effort to make an illegitimate profit, but through attempts to keep his financial loss within the smallest possible limit. Further, it is our belief that of late years estimating conditions and competition have become so bad among general contractors, specialty contractors and sub-bidders that many accept work at, or below, cost, trusting to luck, taking chances, bulldosing, anything almost, including the expectation of favors, even from the architect, to help them come out even, or ahead of the game, all of which we regard as demoralizing, opposed to square dealing, and detrimental to the interests of the owner, architect, the contractor and to the detriment of our profession.

Third—Existing estimating practices are, in our judgment, primarily and largely responsible for the differences which arise between the general contractor and the specialty contractor. That a more equitable and up-to-date method of taking bids can, and should be, devised, embracing such conditions which can, and will, guarantee to every contractor original or "sub," prompt payment according to the actual quantity of work he has properly performed. We believe this to be both practicable and essential in the interests of both contractor and owner. It is our further opinion that such a change will relieve the situation which prompts the increasing demands which are ever being made upon the architect for segregation of almost every trade in a building, and which your committee suggests is not contemplated by the present minimum fee to the architect.

Fourth—Your committee believes that the time has arrived when mechanical work in all trades (with perhaps one or two exceptions) is capable of being accurately measured and described according to practical and well defined standards, which should be agreed upon after consultation with representatives from the different trades involved, and that such standards should be followed in all specifications, and that unit measurements should become the basis of building contracts.

Fifth—Your committee, therefore, recommends that as early as practicable, and in the interest of good practice, there shall be adopted the principle of payment to contractors according to standardized "measurements"; in short, what is known as the "Quantity System of Estimating," and that the details involved in bringing about and perfecting such a system, adapted to local requirements, be taken up and considered by the Chapter as a whole, and as a special order of business, and that this work be continued until such time as the Chapter deems it advisable to take some definite action.

(Signed)
FRANK T. SHEA,
W. H. CRIM, JR.,
G. ALEXANDER WRIGHT,
Chairman.

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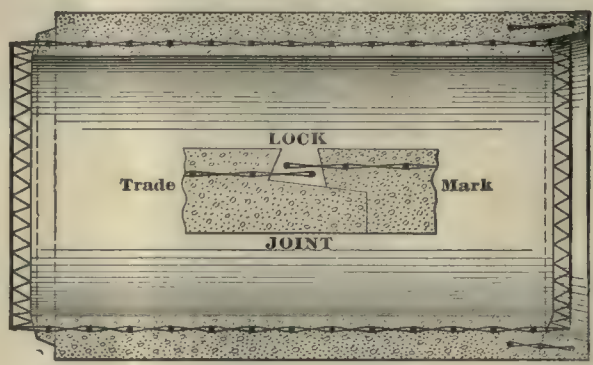

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47.

THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, APRIL, 1914 Number 4

Why Are One-Sided Contracts the Rule With Contractors?

THE business of contracting has grown into one of the largest of the country, employing hundreds of thousands of people, and buying millions of dollars of machinery, equipment, supplies of all kinds.

¶ Yet, there are among contractors many good, able and experienced men who display an astounding lack of knowledge of the law as it relates to contracts.

¶ They cheerfully sign contracts by which they barter away their rights to arbitration, and go even to the extent of depriving themselves of the right of appeal to the courts.

¶ As stated by Mr. Charles Carroll in an address before the National Building Trades and Employers' Association: Contractors secure their final estimates and go, new machinery is invented, construction methods change, but the old form of contract devised many years ago when the contractor was employed practically by the day survives. In those times the ordinary contractor was to all purposes a mechanic. He had little capital, small plant investment and few overhead expenses. In many cases he charged so much per day for his men and the difference between his charges and the wages paid was his only profit. His risks were small, he had little to lose, and consequently the contract was not reasonable, because the loss, if any, would fall almost entirely on the party for whom the work was being done. It is different nowadays. Contracting has developed into one of the larger businesses of the country; millions of dollars are invested in it, and hundreds of thousands of people get their living from it. And yet there are many contractors, good practical men, capable of handling work involving great sums of money, who display a woeful ignorance regarding the law of contracts on which the success of their business depends. In an address delivered last month before the National Building Trades and Employers' Association upon the "Legal Phase of Building Contracts Under Existing Conditions," Charles Carroll points out the pitfalls into which the contractor is liable to tumble through his carelessness in signing onesided contracts. He cites cases to show the absolute necessity of carefully inspecting every contract before it is entered into, to see that the rights of both parties are protected, and he emphasizes the fact that no contractor should enter into any contract by which he barters away his right to arbitration or which deprives him of his rights to resort to the courts of the land to receive justice. He concludes that:

> It ought not to be difficult in this day of thorough organization and thorough knowledge of the details of construction to beforehand prepare a contract covering in detail every point of the work and to define them so plainly and so explicitly that there cannot be any controversy as to the meaning of the contract document. The contractor owes it to himself, to the company that becomes his surety for the proper construction of the work, and to his family, that all of these points be so covered in the contract that no controversies can arise concerning them, and it should be provided in the contract that in case of dispute between the contractor and the architect or owner concerning the proper construction of the work where there is a material question involved that this question should be submitted to arbitration, composed of disinterested persons selected by each side to the controversy, and if the arbitrators thus selected cannot agree, those arbitrators to select some disinterested third person to assist them in settling the question. In this way each party can have the satisfaction of knowing that this case will be passed upon by an impartial tribunal, and one of the parties cannot have the satisfaction of knowing that the question in dispute will be determined by a judge who has been committed from the beginning and who is personally interested on one side of the question.

¶ Frequently, we hear that some contractor has tried to evade the terms of his contract when he found that he was accumulating a loss on the work. His excuse is liable to be that he did not read the contract before he signed it. To those who might be inclined to consider such an excuse, we recommend careful reading of the article on page 50 of this issue. Mr. Thos. H. Ray, the author, very clearly shows that once a contract is signed it is binding on both parties thereto irrespective of their knowledge, or lack of thereof, respecting its terms.

¶ It is a sad reflection on the contractors that they, more than any other business men, are so often involved in controversies of this kind. We invite their attention very strenuously to the statement of the Missouri Court that a man "in possession of his faculties and able to read" should be bound by what he signs even though "he did not know what it contained."

¶ In conclusion, we think that one-sided contracts would cease to exist if contractors did two things: Firstly, read their contracts before signing them and, even better, let a competent attorney advise them. Secondly, organize into a powerful association together with engineers and others interested in contract work, and draft forms of agreements that will be equitable and fair to both parties, and then insist on such standard contracts.

¶ The great results, the results far surpassing the strength of the strongest man, can come only from the power of the mighty men, who stand together.

Weights of Cargoes by Water Displacement

By EMILE LOW*, 606 Ashland Avenue, Buffalo, N. Y.

Even before the completion of the original Erie Canal, which occurred October 26, 1825, the question of accurately ascertaining the amount of freight with which the boats navigating the canals were loaded was a paramount one. This was necessary to insure the collection of the full amount of tolls which the laws of 1820 empowered the Canal Commissioners to establish and collect, and led to the building of two hydrostatic locks, one at Utica and the other at Syracuse. They were found to be useful, their utility becoming more and more apparent with the increase of business.

Previously all articles had to be separately weighed unless the collectors and boatmen could agree in estimating the weight. This system caused much vexation and led to deception and fraud.

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Tonnage by displacement for various load immersions.

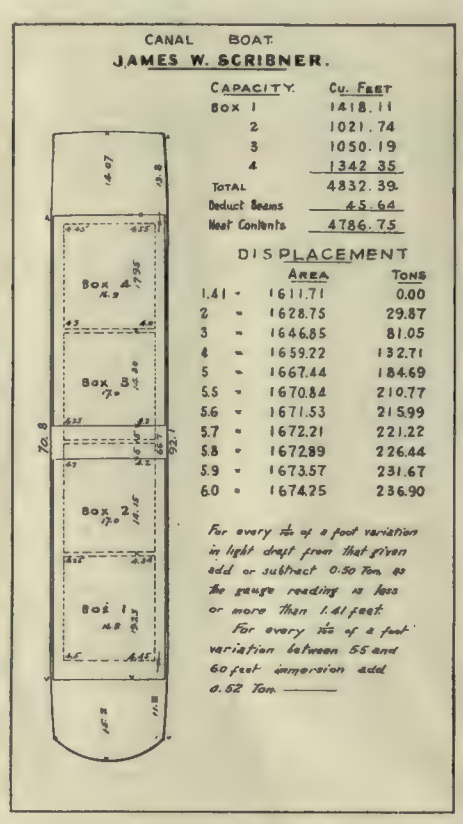
	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2
	TONS	TONS	TONS	TONS	TONS	TONS	TONS	TONS
.00	1023	1037	1052	1066	1081	1095	1109	1124
.005	1024	1038	1053	1067	1081	1096	1110	1125
.01	1024	1039	1053	1068	1082	1096	1111	1125
.015	1025	1040	1054	1068	1083	1097	1112	1126
.02	1026	1040	1055	1069	1083	1098	1112	1127
.025	1027	1041	1055	1070	1084	1099	1113	1127
.03	1027	1042	1056	1071	1085	1099	1114	1128
.035	1028	1042	1057	1071	1086	1100	1114	1129
.04	1029	1043	1058	1072	1086	1101	1115	1130
.045	1029	1044	1058	1073	1087	1101	1116	1130
.05	1030	1045	1059	1073	1088	1102	1117	1131
.055	1031	1045	1060	1074	1089	1103	1117	1132
.06	1032	1046	1060	1075	1089	1104	1118	1132
.065	1032	1047	1061	1076	1090	1104	1119	1133
.07	1033	1047	1062	1076	1091	1105	1119	1134
.075	1034	1048	1063	1077	1091	1106	1120	1135
.08	1035	1049	1063	1078	1092	1107	1121	1135
.085	1035	1050	1064	1078	1093	1107	1122	1136
.09	1036	1050	1065	1079	1094	1108	1122	1137
.095	1037	1051	1065	1080	1094	1109	1123	1137
.10	1037	1052	1066	1081	1095	1109	1124	1138

METHOD OF USING TABLES.
TAKE MEAN OF FORE AND AFT READINGS, LOOK UP CORRESPONDING TONS THEN TAKE MEAN OF LOADED READINGS, LOOK UP CORRESPONDING TONS, DIFFERENCE = LOAD IN TONS

EXAMPLE: LIGHT, FORWARD 1.93 AFT 1.45 MEAN 1.69 = 211
LOADED, " 7.5 " 7.7 " 7.6 = 1037.
DIFFERENCE 826 = LOAD IN TONS.

As examples of the ingenuity developed before the days of large scales, they deserve a brief description and the following excerpt from the Canal Commissioners' report, *Senate Journal*, 1825, pp. 280-281, is of interest.

"These hydrostatic locks are constructed with a chamber sufficiently large to receive any boat used on the canals. The chamber is on the same level with the canal, and is filled from it by a paddle gate which is fixed in a large gate. On a level below the chamber is a receptacle into which by a gate, the chamber can be emptied, and from this through another gate, the water can be discharged. When it is designed to ascertain the weight of a loaded boat, the chamber is first filled, the boat is moved from the canal into the chamber, and the gates closed behind it. The depth of the water in the chamber is then carefully ascertained, and the cubic contents of the water, with the boat floating in it, is at once obtained from a table constructed for the purpose. The water is then drained off into the receptacle, and the boat settles down upon timbers, so arranged as to yield to its shape, by which it is supported, without being strained or injured. The quantity of water drawn from the lock is then ascertained. It is a principle in hydrostatics that every body which floats in water displaces a volume of this fluid, *precisely equal in weight to the floating body.* It appears from the above that the water with the loaded boat floating in it, contained *certain* cubic feet, and that the same water drawn off and measured separately contained *certain* cubic feet, which, subtracted from the preceding, will give the number of cubic feet of water displaced by the loaded boat. This is to be reduced to tons, and the weight of the empty boat, previously ascertained in the same manner, is to be deducted and the remainder will be the weight of the cargo. After an empty boat has been once weighed she is numbered and her weight is registered at the several hydrostatic locks.



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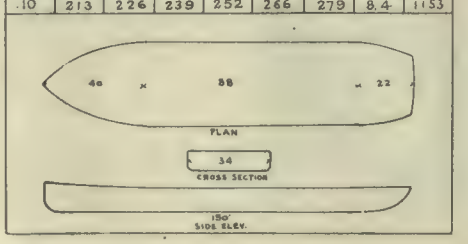
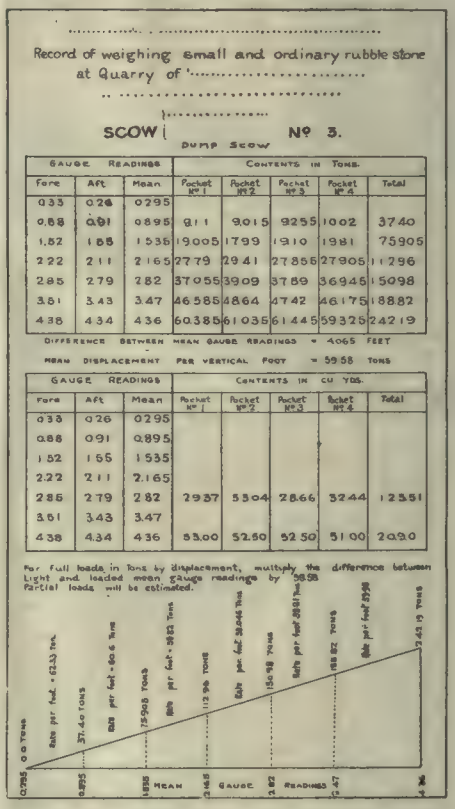
Tonnage by displacement for various load immersions

	1.6	1.7	1.8	1.9	2.0	2.1	GAGE Readings	TONS
	TONS	TONS	TONS	TONS	TONS	TONS		
.00	200	213	226	239	252	266	1.0	121
.005	200	213	226	240	253	266	1.6	200
.01	201	214	227	240	253	267	1.7	213
.015	202	215	228	241	254	268	1.8	226
.02	202	215	228	242	255	268	1.9	239
.025	203	216	229	242	255	269	2.0	252
.03	204	217	230	243	256	270	2.1	266
.035	204	217	230	243	257	270	2.2	279
.04	205	218	231	244	257	271	2.3	293
.045	205	219	232	245	258	272	2.4	306
.05	206	219	232	245	259	272	2.5	320
.055	207	220	233	246	259	273	3.0	388
.06	207	221	234	247	260	274	4.0	526
.065	208	221	235	247	261	274	5.0	660
.07	209	222	235	248	262	275	6.0	808
.075	209	223	236	249	262	276	7.0	951
.08	210	223	236	249	263	276	8.0	1095
.085	211	224	237	250	264	277	8.1	1109
.09	211	225	238	251	264	278	8.2	1124
.095	212	225	238	251	265	279	8.3	1138
.10	213	226	239	252	266	279	8.4	1153





However, in 1828, these hydrostatic locks were replaced by weigh-locks, which operate on the same principle as railroad track scales. As the weighing of canal boats at all times caused much delay and expense, the early attention of inventors was engrossed in substituting some kind of a mechanical device by which the weight of the cargo could be more readily determined.

One of these devices, known as Amsden's hydrostatic scale, which had been under notice for many years, or since 1841, received a favorable report from a committee of the legislature of 1866 and the canal board authorized its limited employment. By its use, the weights of the boat, both light and with its cargo, were ascertained by the amount of water displaced,

*Member of the Society.

as registered in a graduated tube placed amidship. The State Engineers Department, however, was opposed to its extended use, mainly for the reason of it not being under the control of sworn officials of the State.

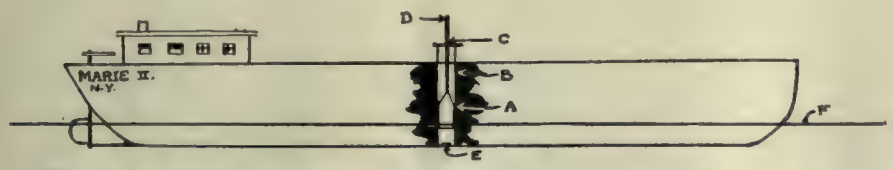


Fig. 1
(*a*) Copper Float. (*b*) Stand Pipe. (*c*) Light Draftmark, zero. (*d*) Graduated Rod. (*e*) Opening with Seive. (*f*) Water Line.

This contrivance consisted of a graduated rod (tube) attached to a water-tight copper float, which rose as cargo was added or placed upon the canal boat.

The zero mark was the light draft and showed displacement of the boat empty, with the exception of the usual furniture which always remained on the boat.

DUMP SCOW
Nº 15
TONNAGE BY DISPLACEMENT
FOR VARIOUS GAUGE READINGS.

Gauge Readings	Load Depths	Tons	Gauge Readings	Load Depths	Tons
.161	00	00	55	389	3801
4035	2425	2466	56	399	3894
41	249	2468	57	409	3987
42	259	2563	58	419	4080
43	269	2659	59	429	4173
44	279	2754	60	439	4266
45	289	2849	61	449	4359
46	299	2945	62	459	4452
47	309	3040	63	469	4545
48	319	3135	64	479	4638
49	329	3231	65	489	4731
50	339	3326	66	499	4824
51	349	3421	67	509	4917
52	359	3517	68	519	5010
53	369	3612	69	529	5103
54	379	3707	70	539	5196
5405	3795	3712	7065	5455	5256

.161	0.0	00	.165	0.04	4.0
1.615	0.005	0.5	1.655	0.045	4.5
1.62	0.01	1.0	1.66	0.05	5.0
1.625	0.015	1.5	1.665	0.055	5.5
1.63	0.02	2.0	1.67	0.06	6.0
1.635	0.025	2.5	1.675	0.065	6.4
1.64	0.03	3.0	1.68	0.07	6.9
1.645	0.035	3.5	1.685	0.075	7.4
			1.69	0.08	7.9

After a known weight was added, the rod was marked, and again at frequent intervals, until the maximum load was reached. The various intervals on the rod were then suitably subdivided and formed the basis for intermediate weights.

The legislature of 1870, as also that of 1871, authorized the use of another contrivance, called Reim's *Detached Boat Scale*. Seven different kinds of boat scales had been under consideration for approval and "Reim's Champion Scales," as they were called, were recommended for use if desired, but did not advise the discontinuance of weigh-locks at that time.

A complete bibliography of "Canal Scales" will be found on page 1335 of the History of New York Canals, 1905, Vol. 2, written by Mr. Noble E. Whitford, M. Am. Soc. C. E.

I desire to call your attention to another contrivance extensively used by contractors engaged in U. S. Government work, and which is shown in detail by Fig. 2.

It is essentially a water-gage, such as is used in steam boilers, modified to suit its new use.

It consists first of a wrought iron (or steel) stand pipe (any ordinary pipe will answer). This is screwed into a suitable flange and attached to the inside of the boat bottom, a hole being bored through the latter for the ingress and outflow of the water in which the boat floats.

Attached to the stand pipe are two steam gage cocks, placed a little over 6 feet apart, center to center, into the unions of which a strong glass tube is inserted and made water-tight by rubber gaskets. This glass tube is protected by four ¼-inch round iron rods against breakage, the rods also being used to hold the graduated 6-foot scale in place by wiring.

The graduated scale is placed between the unions of the cocks, in order to prevent displacement or movement, it being very important that its position is absolute. It will be noted that the contrivance is an exaggerated water gage.

In order to insure comparative accuracy three gages are necessary, one placed forward, one aft, and another amidships..

To use the gages it is necessary to know the exact displacement of the boat at various depths, one of these must be taken when the boat is light and free from water.

This displacement can be obtained by exact measurement and calculating the cubic contents of the immersed hull, or else by noting the immersion by known weights of cargo as obtained by weighing on reliable or tested scales.

EMPIRE LIMESTONE CO
BUFFALO, N.Y.
DECK SCOW KATHRYN
Tonnage by displacement for various load immersions.

	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
.00	1138	1153	1167	1181	1196	1210	1225	1239
.005	1139	1153	1168	1182	1197	1211	1225	1240
.01	1140	1154	1168	1183	1197	1212	1226	1240
.015	1140	1155	1169	1184	1198	1212	1227	1241
.02	1141	1155	1170	1184	1199	1213	1227	1242
.025	1142	1156	1171	1185	1199	1214	1228	1243
.03	1143	1157	1171	1186	1200	1215	1229	1243
.035	1143	1158	1172	1186	1201	1215	1230	1244
.04	1144	1158	1173	1187	1202	1216	1230	1245
.045	1145	1159	1173	1188	1202	1217	1231	1245
.05	1145	1160	1174	1189	1203	1217	1232	1246
.055	1146	1161	1175	1189	1204	1218	1233	1247
.06	1147	1161	1176	1190	1204	1219	1233	1248
.065	1148	1162	1176	1191	1205	1220	1234	1248
.07	1148	1163	1177	1191	1206	1220	1235	1249
.075	1149	1163	1178	1192	1207	1221	1235	1250
.08	1150	1164	1179	1193	1207	1222	1236	1251
.085	1150	1165	1179	1194	1208	1222	1237	1251
.09	1151	1166	1180	1194	1208	1223	1238	1252
.095	1152	1166	1181	1195	1209	1224	1238	1253
.10	1153	1167	1181	1196	1210	1225	1239	1253

In the case of canal boats such as ply on the Erie Canal, there is not much difficulty in determining the displacement from measurements owing to the boxlike shape of the hull, the size of which is fixed by the dimensions of the canal locks. There is comparatively little variation in the dimensions of different canal boats, the average displacement per vertical foot being about 51 tons. The light draft of these boats is about 16 inches, the allowable draft is 6 feet (the Erie Canal is 7 feet deep); this gives a displacement of 240 tons, or 8,000 bushels of wheat.

Where extreme accuracy is not required the immersed depth in feet can be multiplied by 51, which will closely give the weight of the cargo.

Where more exact determinations are asked for, it is well to arrange the displacement in tons and decimals in tabular form, giving the amount for every tenth of a foot (also hundredths) at the light water line, and also at the loaded line.

Nº 8.
Deck Scow
Tonnage by displacement, for various load depths.

	70	71	72	73	74
	Tons	Tons	Tons	Tons	Tons
.00	8814	8944	9073	9202	9332
.005	8821	8950	9079	9209	9338
.01	8827	8957	9086	9215	9345
.015	8834	8963	9092	9222	9351
.02	8840	8970	9099	9228	9358
.025	8847	8976	9105	9235	9364
.03	8853	8983	9112	9241	9371
.035	8860	8989	9118	9248	9377
.04	8866	8996	9125	9254	9384
.045	8873	9002	9131	9261	9390
.05	8879	9009	9138	9267	9397
.055	8886	9015	9144	9274	9403
.06	8892	9021	9150	9280	9409
.065	8899	9028	9157	9287	9416
.07	8905	9034	9163	9293	9422
.075	8912	9041	9170	9300	9429
.08	8918	9047	9176	9306	9435
.085	8925	9054	9183	9313	9442
.09	8931	9060	9189	9319	9448
.095	8938	9067	9196	9326	9455
.10	8944	9073	9202	9332	9461

It may be well to state that the locks of the Erie Canal have a batter of one-half of an inch on each side, to which the hull of the canal boats conform. This gives a somewhat larger displacement at the top than at the bottom. A table of this character would be arranged as follows:

Draft in feet.		Tons.
1.30	.....Light draft, boat empty	0.0
1.40	.....	5.1
1.50	.....	10.2
2.00	.....	35.7
3.00	.....	86.7
4.00	.....	137.7
5.00	.....	188.7
5.70	.....	224.4
5.80	.....	229.5
5.90	.....	234.6
6.00	.....Loaded	240.0

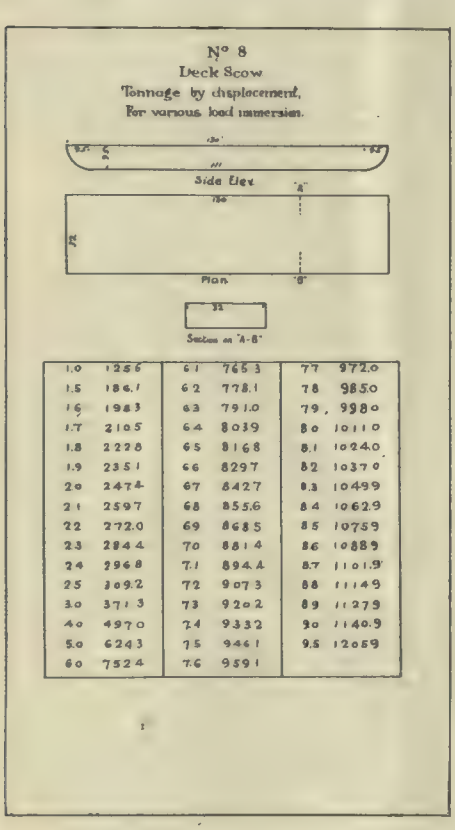
Should the light draft of the boat change for any reason, suitable allowance, plus or minus, must be made in the weights.

In boats of a model not readily measured, the tonnage (weight) must be determined from actual weights and from which information tables can be prepared.

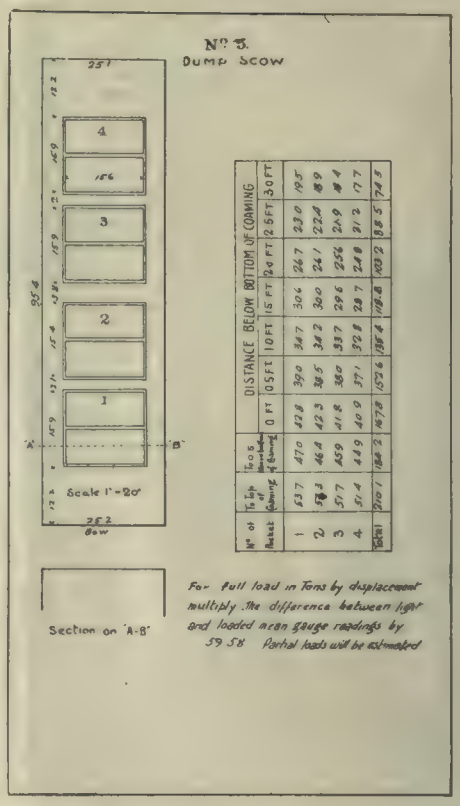
Light readings are first taken, then others as the load is placed, preferably near or at the foot marks, care being taken that the boat is nearly on an even keel. In reading the gages the value of the middle one is doubled, the total addition being divided by four, for the mean.

It is interesting to recall that Trautwine's Civil Engineer's Pocket Book for 1881, page 534, under Article 19, refers to this method of finding the weight of a floating cargo, that is, by the displacement of the water, but not to any appliance for determining the immersed draft.

Fig. 2



1.0	125.6	6.1	765.3	7.7	972.0
1.5	186.1	6.2	778.1	7.8	985.0
1.6	198.3	6.3	791.0	7.9	998.0
1.7	210.5	6.4	803.9	8.0	1011.0
1.8	222.8	6.5	816.8	8.1	1024.0
1.9	235.1	6.6	829.7	8.2	1037.0
2.0	247.4	6.7	842.7	8.3	1049.9
2.1	259.7	6.8	855.6	8.4	1062.9
2.2	272.0	6.9	868.5	8.5	1075.9
2.3	284.4	7.0	881.4	8.6	1088.9
2.4	296.8	7.1	894.4	8.7	1101.9
2.5	309.2	7.2	907.3	8.8	1114.9
3.0	371.3	7.3	920.2	8.9	1127.9
4.0	497.0	7.4	933.2	9.0	1140.9
5.0	624.3	7.5	946.1	9.5	1205.9
6.0	752.4	7.6	959.1		



"Too Busy to Read"

He is a familiar type—the fussy, fretful man who imagines that he is about the busiest fellow in town. He often dumps in the waste-basket, unwrapped, copies of business or technical magazines that contain valuable articles bearing directly on his problems. He fondly believes that he is too busy practising to bother with what others are "preaching."

The trouble with this type of man is that he has not learned that the real executive is the man who so plans his work as to leave a reasonable amount of time for reading and planning.

There are shoals and breakers ahead when the accumulation of new ideas ceases.

The man who declares he has no time to read is unconsciously advertising his small caliber, his slavery to detail, his arrested development.—*Printer's Ink.*

The Railroad Situation in Brief

Returns for February reduced to a per mile of line basis and compared with the returns for February, 1913, show a decrease in total operating revenues per mile of 11.0 per cent, and a decrease in operating expenses per mile of 3.1 per cent. Net operating revenue per mile was less by $88, or 33.8 per cent, than for February, 1913, while that for February, 1913, was 2.4 per cent greater than for February, 1912.—*Bureau of Railway Economics.*

ENGINEERING LAW

Edited by THOMAS H. RAY *
of the New York Bar

On Looking, Leaping and Law

A few days ago a Wisconsin Court found it necessary to use the following language:—

"A man cannot relieve himself from the obligation of a written agreement by showing that he did not read it when he signed it, or did not know what it contained." Ross v. Northrup, King & Co., 144 N. W. 1124.

And again in a recent Missouri Report we read:—

"In general a party who is sui juris and in possession of his faculties, able to read an instrument which he signs, is bound by the instrument, where his signature was not obtained through fraud, even though it did not express the real contract." Ely v. Sutton, 162 S. W. 755.

These judges were only repeating in judicial language the old saying:—"Look before you leap!" But the fact that two appellate courts in different sections of the country found it necessary to say again these words of warning shows that many business men have not yet learned how and when to take advantage of their attorney's knowledge.

It is so much easier, so much wiser, and so much less expensive to avoid doing than to attempt to undo an illegal or foolish act, that a knowledge of law is necessarily of greatest value when it is used in an effort to comply with its provisions and to avoid disputes and litigation. A few illustrative citations will not only be instructive, but should show the wisdom of consulting your attorney before rather than after you have taken your leap.

Some years ago a contractor in an eastern city at the request of its superintendent of roads delivered to him a large quantity of stone and gravel. The material was accepted for city purposes and was actually used in repairing the public highways. When the contractor sought payment from the city, he was unable to show that the purchase had been properly authorized by the City Council, or that the necessity therefor had been properly certified to by one of the city officials as the law required. In spite of the fact that the officer who made the purchase was apparently authorized to do so, and even though the city had accepted the benefits of the contractor's

*Member of the Society.

material and labor he was not permitted to recover its value. He had no right to presume as probably a majority of business men would have done under the circumstances that the officials with whom he was dealing had sufficient authority to bind the city, and after years of expensive litigation he found himself a wiser though a poorer man.

On another occasion an owner submitted plans and specifications to a builder and requested an estimate on certain repair work. The builder prepared his estimate and left it at the owner's office and later in the day the latter sent to the builder a note reading as follows:—

"Upon an agreement to finish fitting up the offices at No. 57 Broadway in two weeks from date you can begin work at once."

"The writer will call again probably between 5 and 6 o'clock."

The builder made no reply to this note but immediately entered upon the performance of the work. After he had partly completed the work the owner countermanded the order and the builder sued the owner claiming that the latter had breached his contract.

He lost his case. Had he first consulted an attorney he should have been advised that the letter which he received was not an acceptance of an offer previously made by him but merely a counter offer by the owner. No contract could arise until this offer was accepted by the builder. His mental determination to accept the owner's offer was not sufficient to legally bind the owner.

The minds of the parties had not met with a determination to contract, and until then there can be no contract in law.

This same principle is well illustrated in the common practice of calling for bids from contractors by an owner who desires to improve his property. Until a bid is accepted by the owner, the contractor retains the right to withdraw the bid, since the bid is but an offer by the contractor to do certain work for a certain price and until it is accepted by the owner there is no contract binding the bidder. Likewise the fact that one bidder is lower than others does not give him any right against the owner.

In public contracting work the rights of the bidder are not so easily determined. Indeed it has been held in one state that a different rule prevails in the case of public contracts and that the bidder on public contract work cannot withdraw his bid after the bids have been acted upon by the proper officials.

The argument presented was that in public contracting all parties are operating under regulatory statutes and subject to the restrictions thereby imposed, and that if bids were permitted to be withdrawn, the highest bidder might be made the lowest by the withdrawal of all other bids, thus inducing fraud.

Aside from the legal questions involved, that contractors are not always sufficiently careful in the preparation of their bids is shown by the number of cases which have arisen, involving the question of the right to withdraw a bid after its acceptance because of an inadvertent error made in the preparation of the bid.

Thus in a recent case in a bid for a public contract, there was an inadvertent transposition of figures as to two items by a bookkeeper who filled out the formal bid and which made a material difference in the total price. In another case a decimal point was misplaced which effected a corresponding difference in the total of the bid. In both cases the contract was awarded before the mistake was discovered.

One of these occurrences took place over two years ago and the matter is still in litigation.

The present prospect is that the contractor will ultimately be relieved of his bad bargain, after two years of legal hair-splitting. But though he may take some personal offence at the phraseology as applied to him, he now admits that there is at least some common sense in the statement of the Missouri Court which said that a man *"in possession of his faculties and able to read"* should be bound by what he signs, even though he "did not know what it contained."

ACCOUNTING DEPARTMENT

Conducted by **HARRY M. SMITH,***
Certified Public Accountant, New York

The March, 1914, issue of the Journal of the Boston Society of Civil Engineers contained a very complete and interesting paper "Cost Accounting on Construction Work" by Mr. Leslie H. Allen, a member of this Society and of the Boston Society of Civil Engineers. It dealt with the system employed by a construction company with which the author is connected, and stated that it had been found after two years of actual working conditions that the system had proven itself to be entirely practicable, affording the information that was required. To quote in part: "the system—is not the dream of a theorist, but something that is really practicable; that is not expensive in operation and that any contractor can use if he has but the patience to study his problem and insist on getting just the results he wants."

It would appear reasonable to state that any system that will produce a maximum of results with a minimum of efforts is worth studying. Therefore the following extract, space not being available for the entire article, is made with the idea of affording the members of this Society, the benefit of the experience of another contractor along lines in which they are probably interested, viz., accurate and intelligent reports from their timekeepers, that will obviously tend to make the cost accounts of greater value.

The extract is as follows:

* Asso. Member of the Society.

Section II.
The Code.

Instructions for the timekeeper are made out in the form of a code, prepared from the standard mnemonic code used by the author. The code differs from that used by other contractors only in the fact that the mnemonic principle is used instead of numbers, and that the divisions of time have been carried a good deal further than is usual. Although this does not seem to be an important item in itself, it is so because it simplifies the work of the timekeeper on the job to a very large extent, and insures more accurate and intelligent reports being made from the job.

All contractors who have attempted any cost keeping will agree on the necessity for some sort of a code to report work done, not on the ground of secrecy but to obtain concise, quick descriptions. It has been found that if timekeepers are simply told to report the work done and describe it, their descriptions will be misleading and verbose, and in going their rounds they will probably make up a code for themselves which afterwards they have to turn into a written description.

It may be worth while to spend a little time in explaining the principles of the mnemonic code used. The initial letter is always a capital and indicates the kind of work to be done. For instance, M stands for concrete Masonry, F for Forms, R for Reinforcing Steel, S for Structural Steel and miscellaneous iron work, B for Brickwork and so on. As far as possible the initial letters are mnemonical, that is, they are the first letters of the items they represent. The second letter is always a vowel and indicates what is being done in the division work which it is describing; "a" stands for making items before setting, and "e" stands for erecting or setting or fixing in place; "i" stands for stripping or removing or pulling down; "o" stands for repairing or patching; "u" is a general utility item, standing for unloading and other similar items. It will be seen that these are mnemonic in that each vowel is the vowel sound of the word that it represents. The third letter, which is always a consonant, indicates mnemonically the place or part of the building in which the work is done, that is, "f" indicates floors, "c" columns, "b" beams, "k" cornice, "l" lumber, "d" doors, and so on. As far as possible these are mnemonic, but it is not possible to make every item so, and some consonants have to be arbitrarily chosen to make out. As the standard code is the same on every job and is used simply with adaptations to meet the requirements of the work in hand, these arbitrary symbols are quickly learned. It will be noticed that the third letter has to be a different one in the case of items relating to plant.

It should be an easy matter to revise this code to apply to any other sort of construction work, or to industrial work of any kind, bearing in mind the general principles on which it is framed.

Although at first sight it looks complicated yet it has been found to be very simple in practice, and new timekeepers and superintendents very quickly pick up its essentials.

It has the advantage that if any work is done on the job which was not known of or contemplated when the original code

was made out, it is a simple matter to adapt the letters and make up a fresh code word for the new work. As a matter of precaution, we always require our timekeepers to give the explanation of a new code word whenever he makes one up, although very often we can read them without such explanation, owing to our familiarity with the principles on which the code is based.

From the standard code as given above, a special code is written out in the head office for the job before the work is started, and from time to time additions are made from the office or by the job, to meet special items of work met with on the job; but all the main items of work, such as concrete in columns and floors, forms, and reinforcement, have the same code word at all times, for example:

M—Concrete.

	Mix	Place	Fill Voids, Smooth	up,
Footings,	Mad	Med	Mod	
Floors and Roof	Maf	Mef	Mof	
Columns,	Mac	Mec	Moc	
Walls,	Maw	Mew	Mow	

rt—Roof trus.

F—Forms.

	Make	Erect	Strip
Footings,	Fad	Fed	Fid
Floors and Roof,	Faf	Fef	Fif
Columns,	Fac	Fec	Fic
Walls,	Faw	Few	Fiw

STANDARD TIMEKEEPING CODE.

Main Division—Kinds of Work.

Initial Letter:

P—Plant.

D—Digging, earthwork and rockwork and items in connection.

M—Concrete.

F—Forms.

R—Reinforcement.

K—Finish of Concrete surfaces.

C—Finish carpentry (windows, flooring, etc.) and any carpentry not belonging to P, D or F.

S—Miscellaneous steel and iron work and other metal work.

B—Brick, masonry, stonework, tile, Akron pipe, etc.

X—Extra work (prefix to any of the above).

Subdivision—Kinds of Labor.

Second Letter (for all main divisions except D and K):

a—Making or preparing, viz., making up forms, mixing concrete, bending or fabricating steel, etc.

e—Erecting, placing or building, viz., erecting forms, placing concrete, laying brick, fixing sash, etc.

i—Removing, stripping or cutting away, viz., stripping forms, cutting away concrete or brick, etc.

o—Repairing, viz., patching voids in concrete, repairing mixer, etc.

u—Receiving, unloading, piling, loading, etc., viz., receiving cement, sand, lumber, etc., unloading and storing same, unloading plant and reloading at close of job, etc.

Second Letter with D:

a—Excavate.
e—Backfill.
i—Pumping.
o—Grading.
u—Drilling and Blasting.

Second Letter with K:

a—Picking.
e—Plastering.
i—Rubbing and carborundum.
o—Repairing, filling voids, cleaning floors, etc.
u—Granolithic finish laid integral with the slab.
ua—Granolithic finish laid after concrete has been set.
y—Cement wash.

Subdivision—Location of Work in the Building.

Third Letter (for all main divisions except P, S and C):

b—
bc—Belt course.
c—Columns.
ch—Column heads (mushroom).
cc—Cinder concrete.
d—Footings.
dp—Drain Pipe (tile).
f—Floors.
fs—Floor slabs.
fb—Floor beams (beam construction).
fm—Corrugated metal to slabs.
g—
h—Cellar or basement.
j—
k—Cornice.
l—Lumber.
m—Monitor or pent house.
n—Lintels.
p—Paving or sidewalk.
q—
r—Rubbish.
s—Stairs.
t—
v—Vault lights.
w—Walls.
rw—Retaining walls.
ws—Window sill.
cw—Curtain walls.
x—Cement.
y—Sand.
z—Stone or gravel.

Third Letter with C:

c—Column.
d—Door.
df—Door frame.
dt—Door trim.
f—Floor.
fb—Floor beam.
fs—Floor screed.
fp—Sub-floor plank.
ft—Top floor maple.
g—Gates.
h—Hardware.
ho—Operating gear.
j—
k—Cornice.
l—Lumber.
m—Monitor or pent house.
ms—Monitor sash.
n—Lintels.
p—Partition.
pl—Platform.
r—Roof.
rb—Roof beam.
rp—Roof plank.
rt—Roof truss.
s—Stairs.
t—
v—
w—
x—
y—
z—Miscellaneous.

Third Letter with S:

b—L-beams, channels, etc.
c—Columns.
cb—Column bases.
d—Doors.
dg—Door guards.
df—Door frames.
ds—Door Sills.
fl—Flashing.
g—
h—
j—Bolts.
k—Cornice.
l—
m—
n—Lintels.
p—Pipe.
q—
r—Railings, grating, etc.
s—Stairs.
sr—Stair rails.
sl—Sleeves.
t—Trusses.
v—Inserts for sprinklers, etc.
w—Windows.
ws—Window shutters.
wg—Window guards.
x—
y—
z—Miscellaneous.

Third Letter with P:

b—Boiler.
c—Crusher and elevator.
ch—Chute.
d—Derrick.
f—
g—Locomotive, portable engine and boiler.
h—Hoisting engine.
j—
k—
l—Elevator tower, bucket and hoist.
m—Mixer and engine.
n—Temporary building.
p—Pump.
q—
r—Runways, staging, ladders and guard rails, etc.
s—Wood-working shop, saw bench, planes, etc.
t—Track.
v—
w—Water supply.
x—
y—
z—Miscellaneous.

State Laws that Contractors Should Bear in Mind

The haling into court this week of six contractors charged with the violation of state laws for the protection of workmen ought to serve as a sufficient reminder to all others that there exist certain laws which, if they are not strictly observed, may result in loss of time, in expense and in probable fine, for the average workman of to-day is on the watch for anything that might indicate that his employer is negligent or not duly respectful of the rights of the employes. Even though the violation of these laws may be more technical than really dangerous to the safety of the workmen, the contractor should take no chances.

Four or five of the charges which took the contractor into court this week arose from a lack of observance of the scaffolding law passed by the last legislature, which prescribes the method in which the scaffolding must be hung or erected to guarantee proper safety.

Another contractor was charged with not providing proper flooring underneath upper stories on which workmen were at work.

Still another state law, information concerning which was sought of the editor this week, is perhaps little known to many. This is in regard to the number of persons that may be allowed to sleep in one room and is enforcible by the health authorities. This law, which has been on the statute books for several years, and which primarily applies to lodging houses and tenements, is also found enforcible in respect to bunk houses of construction camps, established anywhere throughout the state.—*S. W. Contractor.*

EMPLOYMENT BUREAU

Men Available

Actuated by a desire to be of direct assistance to all of its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

003 Junior member of this Society, twenty-three years old, single. Education at Stevens' Institute of Technology, Mechanical and Electrical Engineering. Present position as chief operator in sub-station of an electric railway and light company. Has been employed with three large corporations in the following capacities: Assistant to engineer of tests, start and run tests on boilers, turbines, generators, engines, pumps, etc. Responsible for results. Inspection and analysis of efficiency; able to operate switchboard, put in turbines, etc. Cadet engineer, laying gas mains, erecting pole lines, keeping records of meters, transformers, lamps, etc. Generator tender and switchboard operator. Record A-1.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

006 Superintendent with twenty years' experience in heavy construction operations, competent to handle large jobs successfully. Good reorganizer, now open for engagement. Considered a hustler. Any location. Age 43. Practical experience in installation and operation of cableways, shovel, pile-driving and such apparatus. Member of the Society.

007. A neat little organization with $2,000 to invest, consisting of a competent ESTIMATOR, with four years' successful record (Member of the Society) and a superintendent mason, and a carpenter with four years success in handling concrete work, desire association with an experienced contractor with sufficient financial resources. Write to the Secretary for further particulars.

006 Charter Member of the Society. Employment desired with a railroad company on maintenance of way, revision or appraisal work, or position with a construction company. RECORD: Civil Engineer. Twelve years railroad work as Transitman. Engineer. Roadmaster. Engineer of Maintenance Way. Last five years and at present a member of a construction company engaged in heavy foundation and reinforced concrete construction.

007 Member of the Society. Student graduating as Civil Engineer in June, desires position with construction company. Would prefer work in charge of concrete gangs Has had two summers practical experience in concrete work as follows: Bent and placed reinforcing rods, run a concrete mixer, charge of conrete gang. Handled the instrument, laying out buildings, giving lines and grades and figured quantities of materials required.

Quantity Survey

Movements to establish a Quantity Survey system in this country, similar in principle to the system that prevails in England and Australia, have been started from time to time. Discussions have been frequent among the various professional and trade organizations and in the press, yet little headway has been made to eliminate the greatest element of chance in contracting—that of errors or omissions in the quantities of materials that enter into a prospective structure. Yet most everyone realizes the great expense and gamble entering into the task of estimating plans for any large building, as evidenced by the cartoon of the successful contractor who after learning he was awarded the contract sits down tearing his hair in the mental strain that accompanies his attempt to find out "What did I forget?"

Quantity surveying consists in the creation of a new profession, that of the "Quantity Surveyor," who takes the plans prepared by the architect, estimates the amount of material required for the structure and prepares from this estimate a "bill of quantities;" on this gill of quantities, a copy of which is given each contractor who figures the job, the contractor bases his bid absolutely so far as lists of materials are concerned. The surveyor is paid a fee, not by the contractor but by the owner, as is the architect or the engineer. Thus every contractor starts figuring on an equal footing. On such a basis the successful bidder is not he who has forgotten the sash or doors or one entire story, but the man whose experience, ability to handle such a job and to save where others lose through carelessness or mismanagement, enables him to make a profit at a figure below that of his competitors.

The quantity survey movement on the Pacific Coast is crystallizing in San Francisco where a number of architects, engineers and contractors have been holding meetings during the last six weeks to arrange for the formation of a Council of the American Institute of Quantity Surveyors, a national association now in course of organization throughout the country. The objects of the society are to encourage better methods of estimating and dealing with bids, and to provide a forum where architects, engineers, contractors and others (as associate members) meet upon common ground and discuss methods of bidding upon contract work and similar problems affecting the cost of building.

A report read at one of the meetings last month outlined the purposes of the Council as follows:

"A national society, the 'American Institute of Quantity Surveyors,' is now in course of organization and a movement to establish branches or councils will be at work in New York City, Chicago and Seattle." As the movement grows, other cities will undoubtedly have similar councils. It is proposed that the chairman, vice chairman, and secretary of each council shall represent their council in the national body, and that one additional member of each council for every ten members it possesses in good standing, shall serve upon the national board, to ensure efficient representation. The matter of constitution and by-laws is receiving consideration. When adopted, a copy will be sent to each council. As conditions, trade customs, etc., vary in different parts of the country, the by-laws will be largely suggestive, leaving each council free to make changes that local conditions and self-government may seem to justify.

"Each council to have upon its board a competent local attorney who has had experience with the legislature of the state, and who may be willing to act in an honorary capacity. The services of such a gentleman practicing in New York City willing to serve on the national board as chief counsel, have already been secured.

"The objects of each council to be:

"1. To encourage better methods of estimating and dealing with bids.

"2. To provide a forum where architects, engineers, contractors and owners (as associate members) may meet upon common ground and discuss estimating, contract and similar problems.

"Councils will be expected to take up the local standardization of measurement in the various trades, so that all local engineers, architects, quantity surveyors, contractors, material men, etc., may adopt uniformity in descriptions and measurements. Encouragement should also be given to the standardization of all specifications, thereby reducing their length, without loss of efficiency.

"It has been suggested that the attorneys of councils in conjunction with the chief counsel on the national board, will constitute the legal department of the institute, having the following, among other objects, in view:

"1st. To promote bills before the state legislatures, making it compulsory that when bids are invited for new state buildings, etc., that guaranteed bills of quantities shall be furnished to each bidder, and that such quantities shall represent the quantity of work to be contracted for.

"2nd. To also promote licensing bills providing for the examination and registration of persons who desire to practice as quantity surveyors.

"3rd. To protect the interests of the institue and its councils. Arrangements have been made for the publication under the auspices of the national society of a printed bulletin of information about the quantity system of estimating, and which will be mailed to each member each month.

"Such, then, are some of the objects which it is considered can be attained. The whole trend of the quantity system of estimating is to promote confidence between owner, architect and contractor, and which should always exist. It is, in the long run, against the interests of an owner to put a number of contractors to the trouble of figuring out quantities for a building which he may or may not ever build. A contractor cannot consistently be blamed for trying to break even, after a contract is signed, when he finds that certain quantities have been omitted. Our wretched "methods," and not the contractor, should be criticised in such cases."—*Southwest Contractor.*

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

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Published Monthly by *The American Society of Engineering Contractors, Inc.*, 11 Broadway, New York City, N. Y.

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Vol. II, No. 4 APRIL, 1914 New Series

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THE ENGINEERING CONTRACTOR

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II | NEW YORK, MAY, 1914 | Number 5

The Responsibility of Membership

"CONTRACTORS are the generalizers of the business world," writes Tom Thumtack in Architecture and Building, "they are its optimists and they are its inveterate gamblers. You can't contract a debt and that's how they get their business. The only thing they do contract are debts. The architect takes a gamble now and then in competitions, but the contractor's every deal is a gamble, he is the original guesser."

¶ Why are the conditions so unfortunate and what should be the remedy? Organization of course. But what is organization? It would seem to be insulting to ask a contractor such a question. His business is successful only if based on proper organization and his problems in this direction are more serious than in any more stable and permanent occupation.

¶ Nevertheless, the fact that, thus far, there is barely a class of men who have been more regularly and consistently deprived of their rights is proof that except in his own private business, the contractor has given little evidence of his appreciation or need of co-operation. Therefore, we repeat the query.

¶ As John R. Galloway said: "Organization is the assembling and mutualizing of interests by association and co-operation; it is in fact, a concentration of individual efforts in the direction of a general distribution of responsibility to the end of practical benefits."

¶ We wish to lay extra stress on the individual effort part of the bargain, for it is the essential element in organization, and its efficiency depends largely upon the recognition of our individual responsibilities as members. The individual responsibility of membership is the greatest and most important factor in the life and prosperity of an organization.

¶ We are surrounded by results secured through concentration of effort. Take almost any labor union. It may not always have the loyalty of a large proportion of its membership who, under protest, may continue their participation, being bound together by the successful efforts of the workers who have been able to pass by consideration of personal direct or indirect benefit. Yet it is always on the alert and in times of peace is preparing for war.

¶ In a little over twenty years the American Federation of Labor acquired a membership of over sixteen hundred thousand. What an object lesson to contractors. How was it accomplished? Simply through concentration of effort.

¶ There will never be an organization that will pilot the feet of idlers soaked in discontent, along the road to Easy Street, says Galloway, and he is right. The man who looks to any organization for bunk and grub will get to the poorhouse when he is through with his tale of woes.

¶ Therefore, while your officers and directors are doing their best to improve conditions imposed on the contractor, you the members of The American Society of Engineering Contractors should also do yours. Many ways will suggest themselves but if you cannot easily discover any, just drop a line in the chute that leads to the continuous mixer of ideas working gratuitously overtime at headquarters, and watch the results.

The Present Status of the Unit Method of Reinforced Concrete Construction

By J. E. CONZLEMAN*, C. E., Berwyn, Ill.

Paper read at a meeting of the St. Louis Branch

Unit construction has arrived. The large number of structures built after this method, during the last few years, show that unit construction methods can be successfully used for practically all kinds of reinforced concrete construction. We now know that contracting companies exploiting unit methods have a chance of obtaining contracts in open competition.

In a great many types of buildings unit construction is so obviously the logical and elegant way, that, to one familiar with these methods, the usual construction seems most crude and cumbersome.

The change in the attitude of the architects and engineers toward this type of construction is nothing short of marvelous, and it is very gratifying to those of us, who, during the last few years, have advocated unit construction in the face of almost universal adverse criticism, to be able to say that our labors have not been in vain.

With your permission I shall consider the general subject of unit construction very briefly before confining myself to the subject matter of this paper. In order to save words I shall use the term "monolithic concrete" to indicate concrete that has been deposited in its final position into forms in the usual manner. This word "monolithic" by the way has been responsible for much misapprehension as to the nature and properties of reinforced concrete structures. No building or large structure is monolithic, using the word in its proper meaning.

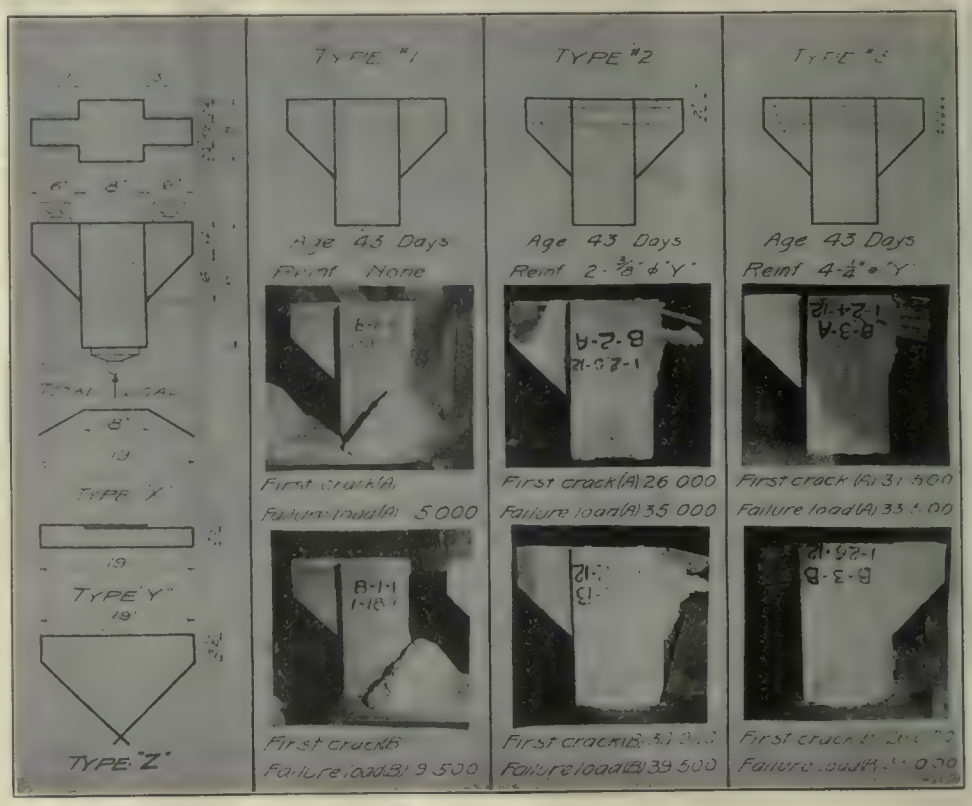


FIG. 1

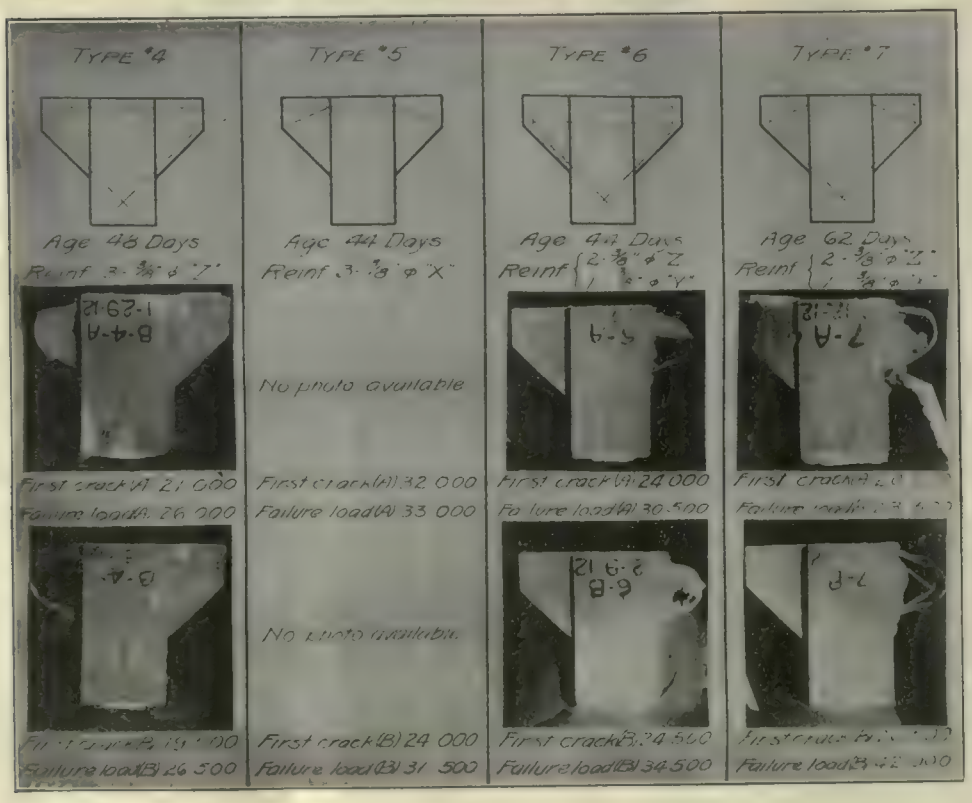


FIG. 2

We now know, or rather we better realize that we have always known, that the usual reinforced concrete building is not "a monolith carved out of the solid rock" as we used to read in some of the catalogues, but has a great many cracks and joints. The cracks are a necessary result of the method of construction which involves the pouring of a large expanse of concrete at one time; this concrete must shrink as it dries out, and cracks inevitably follow. Temperature stresses are also a prolific source of cracks. Joints occur whenever the work is stopped even though the interruption in the pouring is of very short duration.

Admitting then the existence of joints and cracks, does it not appear logical to adopt a method of construction which eliminates the shrinkage proposition; partially eliminates temperature stress, and finally puts all the joints just where the designer intended they should come?

The possibilities of properly inspecting the finished product before it is incorporated into the structure is a great advantage peculiar to unit construction. You do not, as a rule (at least if you are at all particular as to quality), buy finished lumber before the bark is taken off of the tree, and yet a great many people are satisfied to purchase reinforced concrete just that way.

You cannot place too high a value on this one great advantage of unit methods.

*Member of the Society.

FIG. 3

Just think of the loss of life and property that would have been averted if the art of reinforced concrete construction had *begun* with unit methods instead of ending with them. No accidents from premature removal of forms can occur when unit methods are used.

The subject of unit construction has been discussed to such an extent recently that further exposition of its advantages seems superfluous. However, as the subject is a most important one, I will mention a few of the more obvious points of superiority.

Under unit methods it is entirely possible to follow a well thought out program for the work in hand. The forms are bedded on the ground in a suitable casting yard and the work so arranged that a routine operation results. This means that it has finally been possible to enforce factory methods in construction operations, and factory methods, applied to the contracting field, mean order out of chaos.

Forms for similar units are grouped together, thus making inspection and the checking of the reinforcement an easy matter.

The placing of the steel can be done more easily and with greater accuracy; and the reinforcement is not so likely to be displaced as in a monolithic building where there is necessarily considerable walking or wheeling over the steel that has been placed.

It is possible to make very thin sections when units such as wall slabs are cast flat; this results in economy of materials.

Unit forms can be kept clean—shavings sticks, etc., cannot be washed into them from connecting forms as is the case in monolithic work.

The question of inspection and testing of the units has been treated fully above. It may, however, be necessary to explain how shrinkage is eliminated. I grant you that each individual unit will have its own internal shrinkage distresses, but these are not cumulative and do not affect the structure as a whole. The shrinkage of the small amount of grout used cannot affect the structure.

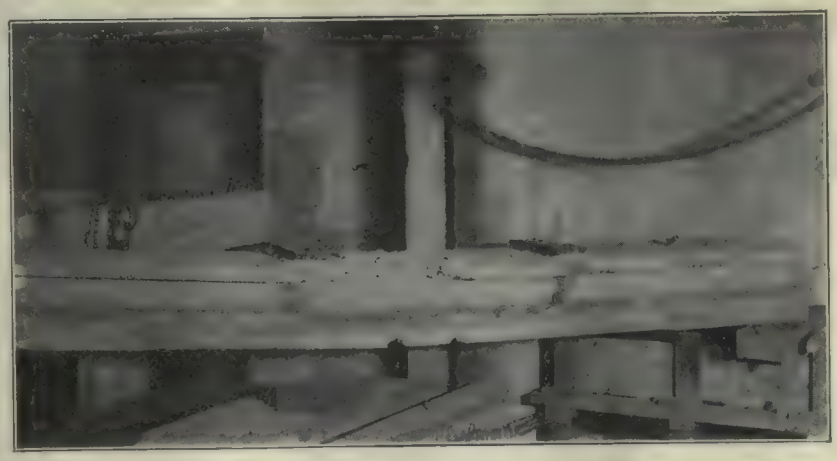
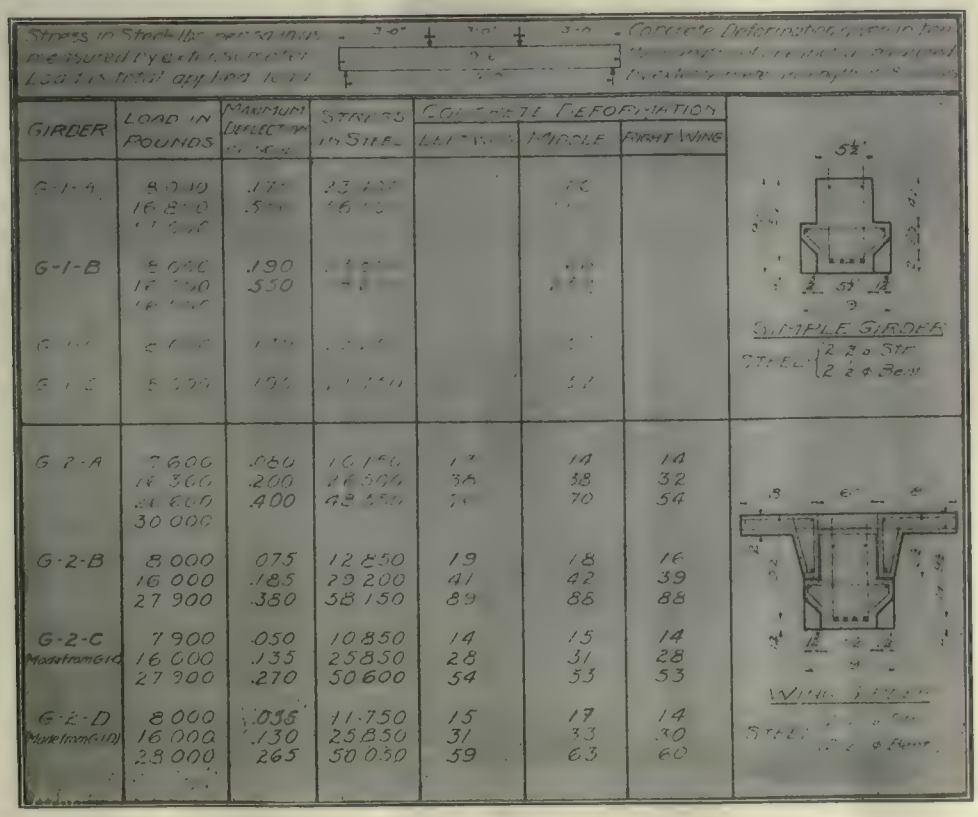


FIG. 4



GIRDER	LOAD IN POUNDS	MAXIMUM DEFLECTION	STRESS IN STEEL	CONCRETE DEFORMATION		
				LEFT WING	MIDDLE	RIGHT WING
G-1-A	8 000 16 800 [illegible]	.17[illegible] .5[illegible]	23 [illegible] [illegible]		[illegible]	
G-1-B	8 000 16 [illegible] [illegible]	.190 .550	[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
[illegible]	5 [illegible]	19[illegible]	[illegible]		5[illegible]	
G-2-A	7 600 16 300 26 600 30 000	.080 .200 .400	16 150 26 500 42 [illegible]	1[illegible] 38 7[illegible]	14 38 70	14 32 54
G-2-B	8 000 16 000 27 900	.075 .185 .380	12 850 23 200 58 150	19 41 89	18 42 88	16 39 88
G-2-C Made from G-1-C	7 900 16 000 27 900	.050 .135 .270	10 850 25 850 50 600	14 28 54	15 31 53	14 28 53
G-2-D Made from G-1-D	8 000 16 000 28 000	.035 .130 .265	11 750 25 850 50 030	15 31 59	17 33 63	14 30 60

FIG. 5

It would be possible to give many other advantages of unit construction methods but I will desist and close this portion of my paper by saying that in my contracting experience, unit methods have made possible the adoption of reinforced concrete for buildings that would otherwise have been built of ordinary construction on account of the excessive cost of monolithic construction.

It will not be out of place at this point to briefly review the work that has been done under unit methods.

The first unit constructed buildings of which we have a record were constructed during 1908 by Mr. William Mason, Superintendent of the Edison Portland Cement Company at New Village, N. J. These were one story buildings constructed of unit columns, girders and slabs, the walls being built in the usual way. No attempt was made to connect these units by means of projecting bars and grout, but the columns and girders were fastened together by means of steel splice plates and bolts.

At about this same time a warehouse was built in Kansas City from designs prepared by the writer. In this building rigid joints were obtained by means of projecting bars and a small amount of field concrete, the wall slabs were also cast flat and set into place.

During 1909 a building was constructed at Reading, Pa., for the Textile Machine

FIG. 6

Company of New York according to the Visintini method.

During the same year a car barn was built at Harrisburg, Pa., under the direction of Mr. Mason D. Pratt, according to unit methods. This building is of similar construction to the Kiln Buildings of the Edison Portland Cement Company except that the wall slabs were also cast unit. No attempt was made to obtain a rigid or unitary structure by means of specially

During last year a building was designed and constructed under the direction of Mr. Chas. D. Watson at Syracuse, N. Y. This is a one story building with bolted connections between members.

Mr. Watson read a paper at the 1910 meeting of the National Association of Cement Users' Convention in which he covered the field of Unit Construction thoroughly. A large portion of this paper is devoted to the description of unit floor joist, or unit floor systems, and brings out the fact that at that date the largest application of Unit Methods was in such construction. I mention this fact because it shows that only two years ago Unit Construction, as we now use that term, was not highly developed, at least in the Eastern States.

Outside of building construction unit methods have been extensively used by the railroad companies for the construction of bridges. Notable examples of pioneer work of this kind can be found in the track elevation work in Chicago. Several arch bridges of the three hinge type have been constructed in the extreme West under patents granted to W. M. Thomas, one of these bridges having arches with spans of 103 feet.

The Ransome Engineering Company of New York has also developed a unit method, and has constructed quite a few buildings; this method is a great advance over the construction described as it can be applied to buildings of more than one story in height. In this system, however, the floor slab is poured "in situ," making the construction only partially unit. As you know, the floor slab concrete is a large percentage of the total and it seems to me that a large proportion of the saving made possible by unit methods is therefore lost.

There have been quite a few buildings constructed by this method, and the following are the more important:

A four story manufacturing building for the United Shoe Machinery Company at Beverly, Mass. This building is of pleasing architectural design, being, in fact, an addition to existing buildings which had also been built under Mr. Ransome's supervision. It is stated that quite a substantial saving in cost was affected by the adoption of the unit method.

In Boston, during the last two years, several buildings have been constructed by this method by the local licensees of the Ransome Engineering Company.

The first application of this method was is the construction of an office building for the Foster Armstrong Company, near Rochester, N. Y. This building has brick bearing walls, its dimensions being 50x60 feet, two stories and basement.

Even in this well devised method there is still no attempt made to obtain the rigidity and continuous action that should be the

FIG. 7

FIG. 8

Works. This building was constructed under the direction of the Concrete Steel distinguishing feature of reinforced concrete construction whether unit or monolithic.

A successful unit system must, therefore be one which can be applied to the construction of practically all structures which would ordinarly be built of reinforced concrete. An example will illustrate the point I am trying to make. Suppose it was desired to construct a very tall building on a very narrow lot. In this case the stresses from horizontal wind loads would have to be taken into account. It is evident at once that a unit method of construction could not be used in this instance, unless it were one in which the joints were so designed that the necessary stiffness and knee brace action could be developed.

The Unit Construction Company of St. Louis has such a system, and during the last five years has perfected its methods to such a degree that structures, which have all the rigidity characteristic of the monolithic type, can be erected in which only three per cent of the total concrete is poured "in situ." All the joints in this system are made by means of projecting reinforcement. The bars projecting from abutting units are made to lap a sufficient length to develop the requisite strength when imbedded in the grout which is used to make the connection. As this company is by far the largest factor in the unit construction field (in fact the only large company exploiting unit methods) a description of the present status of unit construction will necessarily treat largely of their work. This is especially so since the Unit Construction Company has recently acquired the patents and good will of the Ransome Engineering Company.

Unit construction affords a great field for research work, and in order to develop and demonstrate our methods, a testing laboratory was equipped with a 50,000-lb. testing machine and other necessary apparatus. This laboratory has proven to be a very valuable adjunct to the Engineering Department. Among the experiments that have been made are two series which, I think, are of sufficient interests to merit description. The one series was devised to throw some light on the subject of bracket design; the other on the action of girders after connections had been gouted.

In regard to tests on brackets; These were made because there is no satisfactory analysis for bracket design and no experimental data is available. It is hoped that the information derived from these experiments may be of value to the profession.

The dimensions of the specimens are clearly shown in Figure 1. The concrete was a 1:2:4 mix., the aggregate being Merimac River sand and gravel. The specimens were tested in an inverted position on account of greater ease in handling. The load was applied through a hardened steel ball bearing in a cup-shaped depression in a heavy steel plate. The brackets rested on 1x4 steel plates carried on rollers as indicated in sketch. Even bearing between plates and concrete was assured by means of plaster of paris joints. Seven types of brackets were tested; type one being without reinforcement—the others reinforced as shown.

Three types of reinforcement were used, singly and in combination. Type X is a short length of bar bent downwards at each end; type Y consists of a single bar bent in the shape of a rectangle; type Z consists of a single bar bent to follow the shape of the bracket. The type Z reinforcement is, as you know, the type usually employed.

The specimens were tested at the age of six weeks, as near as possible, except type No. 7 specimens, which were tested at the age of 62 days. Two specimes of each type were tested, and Figures 1 and 2 show clearly the condition of the specimens after failure. The load causing the first noticeable crack, and the load causing failure, are also shown. The position and extent of the cracks are shown in the sketch of each type.

FIG. 9

As was to be expected, none of the specimens failed through tension in the steel. The failures were due to shearing or diagonal tensile stresses, and insufficient bond. The action is similar to that which exists at the end of a beam, the condition is aggravated, however, by the difficulty of securing sufficient bond to develop high stresses in the steel.

Although the conclusions that are derived from these tests are not final, yet the fact is brought out that the type of bracket ordinarily used is the least efficient of the forms tested. The failure is fairly sudden and the concrete is almost completely destroyed. The most satisfactory form is type Y or closed loop. With a number of loops spaced close together the failure is slow and even after the concrete is partially destroyed, considerable load carrying capacity exists. This feature is shown by the photographs of type 3, in Figure 1.

FIG. 10

FIG. 11

The average shear per square inch on the vertical plane of junction with the column at first load and the failure is given in the following table:

Type.	Shear at first crack.	Shear at failure.
1	100 No. per sq. in.	100 No. per sq. in.
2	400 " " " "	530 " " " "
3	410 " " " "	490 " " " "
4	285 " " " "	375 " " " "
5	400 " " " "	460 " " " "
6	345 " " " "	465 " " " "
7	330 " " " "	470 " " " "

A study of these tests leads to the conclusion that the most efficient reinforcement would be the Y type loop bars, some of which would be bent downwards into the bracket. Another series of tests to determine this point is now being made.

An understanding of the details of our system will assist in the understanding of the purpose of the girder tests. I will, therefore, before describing these tests, give a brief outline of our methods.

Typical details are shown in Figure 2, such as would be used in the usual building. The girders rest on the column brackets. The arrangement of the main reinforcement for the girders follows usual practice; some of the bars being bent up and carried up over the support. These bent up bars project from the unit and lap the bars from the abutting girder. The length of lap is made sufficient to develop the requisite stresses in these bars. You will, therefore, see that after the grout is poured the girders are as truly continuous as in ordinary monolithic construction. Please note that the stirrups project above the girder and form loops so as to make a strong connection with the grout which is poured on top of the girder.

The floor slabs rest for their full width on the girder ledge, projecting bars extending into the grout space over the girder. It is evident that after the grout has hardened, the strength of the girder will be greatly increased on the compression side. In other words, T-beam action results and the experiments are intended to throw light on this action.

Figure 3 shows a continuous girder test. The concrete blocks representing the column caps are supported on rollers, the cantilever ends are grouted to the column cap and interior girder in the usual way.

Figure 4 gives a view of a wing girder showing a failure of compression flange.

The results of the tests on simple and wing girders are given in the table included in Figure. 5 The wing girders failed in tension, the simple girders in compression. The concrete was a 1:2:4 sand and gravel mix; the reinforcement high elastic limit corrugated bars. The load was applied at the third points. The extension of the steel was measured on a distance of 8 at mid-span, the deformation of the concrete was also measured, steel buttons being set in for this purpose. Readings were made to the nearest one ten-thousandth of an inch, and corrections were made for temperature.

Referring to the wing girders you will see that the deformation of the wings agrees closely with that of the grout over the girder; this means that these wings carried their full share of stress and that full T-beam action was secured. The wing girders carried twice the load borne by the simple beams.

Unit Construction presents new problems to the contractor, and the problems cover not only the erection, but the casting of the units as well. The difficulties met with in pouring units differ from those encountered in ordinary monolithic work. This results from the fact that in unit work it is necessary to fill a great many individual forms each day, while in monolithic work a comparatively large amount of concrete can be poured in about the same location. In the attempt to meet these new conditions we have tried out various types of mixing plants. Two of these plants are of sufficient interest, I believe, to merit description here.

Figure 6 shows the yard layout for the construction of a plant for the National Lead Company in St. Louis. The sand and gravel were received in hopper bottom cars. A bucket elevator carried the aggregate from the hopper under the track to the bins over the mixer. A mixer mounted under the bins was arranged to discharge into concrete cars which were operated by a cable, on the elevated track shown. These cars were stopped where required, and the concrete dumped into the receiving hopper on the movable distributing spouts. As the spout hoppers were equipped with discharge gates, the flow of concrete could be readily controlled.

FIG. 12

The casting yard was served by a stiff leg derrick mounted on a tower. The derrick travelled the length of the yard and lifted the hardened units from the forms and placed them in the storage yard. A locomotive crane loaded the units onto flat cars and pushed them to the building site. The erection was done by a stiff leg derrick mounted on a high traveller.

The buildings are shown in Figures 6, 7 and 8. As far as my knowledge goes, the five story building shown in Figure 7 was the first building over one story in height built entirely of units.

Figure 9 shows the yard layout for the Memphis Terminal Corporation work at Memphis, Tenn. In this plant the casting yard is circular, the forms being arranged around the concrete distributor. This distributor consists essentially of a structural steel arm, 130 feet long, revolving through an angle of 270 degrees. This arm is attached to a mast held by stiff legs anchored to heavy concrete footings. The arm carries three spouts as shown in the illustration. With the combination of motions thus obtained, every point of the casting yard can be reached for a radius of 150.

The mixer and concrete hoist is placed behind the mast, a three way valve, operated by a man on top of the tower, directs the concrete into any one of the spouts.

The casting yard is served by two locomotive cranes, these pick the units from the forms, load them on cars and push them to the buildings.

Figure 10 shows F. O. B. sheds at Memphis, under construction.

FIG. 13

The method of constructing the plant of the Sturges & Burn Mfg. Co. at Bellwood, (near Chicago) is shown in Figure 11. By unit methods it is possible to construct saw-tooth buildings of reinforced concrete at reasonable cost.

Figures 12 and 13 show the construction of a Cotton Mill for the Post Cotton Mills at Post, Texas. This plant comprises six buildings, only two of which are shown.

Figure 12 shows a part view of Mill Building. Figure 13 shows a view of the Powerhouse during construction, showing 42' reinforced concrete roof trusses.

EMPLOYMENT BUREAU

Men Available

Actuated by a desire to be of direct assistance to all of its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

003 Junior member of this Society, twenty-three years old, single. Education at Stevens' Institute of Technology, Mechanical and Electrical Engineering. Present position as chief operator in sub-station of an electric railway and light company. Has been employed with three large corporations in the following capacities: Assistant to engineer of tests, start and run tests on boilers, turbines, generators, engines, pumps, etc. Responsible for results. Inspection and analysis of efficiency; able to operate switchboard, put in turbines, etc. Cadet engineer, laying gas mains, erecting pole lines, keeping records of meters, transformers, lamps, etc. Generator tender and switchboard operator. Record A-1.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

006 Superintendent with twenty years' experience in heavy construction operations, competent to handle large jobs successfully. Good reorganizer, now open for engagement. Considered a hustler. Any location. Age 43. Practical experience in installation and operation of cableways, shovel, pile-driving and such apparatus. Member of the Society.

007. A neat little organization with $2,000 to invest, consisting of a competent ESTIMATOR, with four years' successful record (Member of the Society) and a superintendent mason, and a carpenter with four years success in handling concrete work, desire association with an experienced contractor with sufficient financial resources. Write to the Secretary for further particulars.

008 Charter Member of the Society. Employment desired with a railroad company on maintenance of way, revision or appraisal work, or position with a construction company. RECORD: Civil Engineer. Twelve years railroad work as Transitman. Engineer. Roadmaster. Engineer of Maintenance Way. Last five years and at present a member of a construction company engaged in heavy foundation and reinforced concrete construction.

009 Member of the Society. Student graduating as Civil Engineer in June, desires position with construction company. Would prefer work in charge of concrete gangs Has had two summers practical experience in concrete work as follows: Bent and placed reinforcing rods, run a concrete mixer, charge of conrete gang. Handled the instrument, laying out buildings, giving lines and grades and figured quantities of materials required.

ENGINEERING LAW

Edited by THOMAS H. RAY *
of the New York Bar

Preparation of Bids

Numerous legal questions have arisen concerning the rights and duties of contractors in the preparation of their bids. We have previously stated that the bid offered by a contractor, at least in private contracting work, amounts merely to an offer and there is no legal obligation imposed on either party until the acceptance of the bid by the owner. In public contract work no obligation is imposed upon the state or municipality until after an award of the contract has been made. But it should be noted that where an award has been made, even though no written contract has been entered into, the rights of the parties are fixed. If the city or state thereafter refuse to enter into the written contract, the contractor has a cause of action because there has arisen between the parties "a contract to contract." If the public officials refuse, for any reason, to enter into a formal written agreement this "contract to contract" is breached, and the contractor may recover the damages sustained.

It seems that however much effort is made to prepare a complete contract, there are always some matters left in dispute. Especially is this so where the work is of considerable magnitude, as on large public undertakings. And much litigation has arisen out of the question as to how far the contractor is bound to make an examination of the site of the work to determine the nature and extent of the work before bidding.

It may be said as a broad proposition that where an opportunity is given to the bidder to make an examination of the site of the work in order that he may thereby satisfy himself as to its nature and as to the accuracy of the plans and specifications, that no recovery can be had for work not specifically provided for unless the actual conditions do not coincide with the represented conditions to such an extent that the owner is responsible for the resulting deception of the contractor. The misrepresentation must be such that the contractor is unable to discover it upon the examination permitted.

For example, in a case where the contractor agreed to furnish material and grade and pave a street "agreeable to the profile of said street on file in the office of the street commissioner, and to keep the same in order for one year," after the work was done the street sank about eleven feet and the defendant refused to pay plaintiff unless he filled up the depression. The profile exhibited the proposed changes, but the amount of filling and excavation was a matter of calculation. The court decided that the plaintiff could not recover until he had performed the work.

"The character of the soil, etc., were as well known to the plaintiff as to the defendant, and were open to his examination and survey, and the map and profile which were the basis of the contract disclosed upon its face the existence of the swamp which it is now claimed required the excess of earth to fill."

"The plaintiff expressly agreed with full knowledge or the means of knowledge of all the facts at his command to grade and pave the avenue over and across the swamp and to keep it in repair for one year, after its completion."

But the contractor is not bound as to matters which an examination will not disclose to be different than represented, so that the contractor is entitled to rely upon the representations made in submitting his bid. In another case the plaintiff contracted with defendant to clear, drain and concrete the bottom of a park lake. The contract provided that the contractor should drain off the water from the bottom of the lake during progress of the work, furnish all pumping necessary for the proper prosecution of the work, and that he should satisfy himself as to the nature and amount of work to be done by a personal examination of the location.

There was an outlet pipe in the bottom of the lake only the gate of which was visible upon the contractor's examination. But on his attempting to drain off the water thereby, the sewer itself proved to be obstructed, and failed to drain below a certain depth. The contractor was therefore compelled to pump out the water and claimed damages for such extra work. It was held that the contract did not contemplate the contractor's pumping out the water in that sense, but that he could properly assume that the water could be discharged through the outlet which the city had constructed for that purpose. And he was entitled to recover, as for extra work, the cost of pumping necessitated by the failure of the city to have the outlet pipe in working order, since it was impossible for the contractor to tell by an examination whether or not the outlet pipe was in working order.

The city was liable because it failed in the agreement which could be implied from the specifications, that it would maintain an outlet at the bottom of the pond, and the contractor was damaged to the extent that he was required to do work which the contract did not contemplate.

It has been held that even where the contract contains a provision to the effect that all damages arising from any unforseen obstacles shall be assumed by the contractor, that he may still recover for any extra work made necessary because of a misrepresentation by the owner. But it must first be determined that the work for which payment is sought does not come within the contract.

There was such a clause in the contract in the case cited above. It was held that this provision applied to the work to be done and to the unforseen obstructions or difficulties which might be encountered under the contract, and therefore did not affect the claim for extra work to which the contractor was subjected by reason of the unforseen obstruction in the outlet pipe, such obstruction being entirely outside the contract.

If no examination is permitted the contractor before making his bid, he may rely upon such representations as are made in the plans and specifications for the purpose of showing that something exists which will facilitate and render less expensive the performance of the work. And if plans are offered for the examination of the prospective bidder which are apparently sufficient to enable him to compute his bid and thereafter the plans are altered so as to make the prosecution of the work more expensive the contractor may recover for the extra work made necessary by the changes.

The bidder is also entitled to rely upon representations which are contained in the specifications as to the character of the work which is to be done. For example, a statement to the effect that "the pipe line is mostly and the tunnels are entirely to be in soft shale rock," is a warranty as to the quality of the excavation.

Where there is a written contract and also a plan if there is any discrepancy between the two, the writing controls and the plan should be regarded as subsidiary thereto.

The rule for the interpretation of contracts is to give effect to every part of them, if possible. The meaning of the agreement is to be gathered from the consideration of all of its provisions keeping in mind the intent and object of the parties in making the contract and the result which they intend to accomplish by its performance. For example, in a certain case one of the specifications called for French glass in the front windows and another provided that all glass to be used in windows should be of the best American cylinder glass. The court decided that the two provisions should be construed together so as to require the use of American cylinder glass in all but the front windows.

Likewise in another case one specification provided for walls to be plastered with King cement under the direction of the superintendent of King & Co., and a second specification provided that cement and sand should be used in equal proportions. The court in interpretating this contract held that full effect could be given to each of the specifications and said:—

"The plastering—that is the laying of plaster on the walls, was to be subject to the direction of the superintendent, but the ingredients of the plaster and the proportions were to be those provided for in the contract. It cannot be supposed that these were to be subject to modification of the superintendent because on the proportion of the ingredients of the plaster the cost and value of the work largely depended."

State Highway Man's Song

Graft and the world grafts with you,
Probe and you probe alone.
For the sad old world has need of more coin,
But has virtue enough of its own.

N. Y. Press.

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*Member of the Society.

ACCOUNTING DEPARTMENT

Conducted by HARRY M. SMITH,*
Certified Public Accountant, New York

The "Engineering News" for March, 1914, contained the following article, "A Practical Cost-Keeping System for Contractors," by Mr. Everett N. Bryan, which is reproduced in full.

In reproducing articles of the kind, it is the intention to offer comments upon them in an early issue. Considerable weight, however, would be added if the members who are interested and who desire to add to the influence of this Society, would forward their personal comments on the articles that have been published. They, because of their actual experience, can readily point out certain details that can be improved. It will be found that by utilizing such practical suggestions that an effective system of uniform accounts may be constructed. It is to be hoped that a generous response will be made to this invitation to take an active part in the work that is being done.

The eternal question with engineer and contractor alike is "What will it cost?" The surest answer lies in data collected from one's own past experience; still it is surprising how widely one must search to find any construction work being executed under a really comprehensive cost system.

The cost-keeping system used by T. K. Beard, contractor, Modesto, Calif., is original and efficient. It is the result of several years' experiment, selection and discard. It accomplishes a twofold purpose. It supplies in detail a record of the cost of the various operations attached to each piece of work. Data thus obtained are used in future estimates, and at the same time supply in exellent detail, and right up to date, information as to the progress of each contract, and the cost of all operations involved, thus making possible a study of men and methods and changes in plans if the work is not progressing satisfactorily.

The means of accomplishing these ends is through a system of weekly reports. The execution of the work involved is under the direction of the engineering department. The head of that department assists in preparing estimates for bids and in planning plant layouts, etc. He is therefore familiar with all details of the contract before the actual work starts, and while the estimate is fresh in mind strikes off a form or outline and forwards it to the timekeeper by which the latter may group all expense items as he reports them in the weekly report.

This form shows to what account each expense item and credit should be charged. It is an analysis of the work to be carried out by the contractor and isolates each individual operation involved. Thus for example, a recent contract comprised work under three main headings:

(1) Steam Shovel Excavation of Shale Rock.

(2) Hand Excavation of Hard Basaltic Rock.

(3) Hydraulic Excavation of Thin Top Layer of Gravelly Clay.

The work under each of these main headings was further subdivided into the various logical parts representing the more elementary operations. The value of a knowledge of these components is shown by the manner of preparing the bid for the steam-shovel excavation job. The total cost of this work was found by adding the costs of the following minor operations:

1. Plant Delivery
2. Superintendence
3. Breaking Ground
4. Machine Mucking
5. Transportation of Muck
6. Dump Expense
7. Trestle Erection
8. Riprapping Sides of Embankment Made with Shovel Muck
9. Deepening 18 in. the Canal from Whose Sides Shovel Was Excavating.
10. Miscellaneous Expense.

This subdivision is very different from the conventional analysis of costs whose subdivisions are "Labor, Machine Rental, Fuel, etc." The present method makes each of the elementary operations involved an account by itself, and the data for it complete. It would be difficult to imagine two pieces of steam-shovel work so dissimilar that the data from some of the divisions of one could not be used in estimating upon the other. In very hard rock the cost for "breaking ground" will run high, and in all probability the cost of other operations will increase slightly, due to the decreased yardage excavated per shift. But a small experience should teach anyone quickly the possible yardage for any particular size shovel in the various classes of material, if the shovel is free to work out its capacity without being limited by other operations involved.

In regard to "Riprapping" and "Deepening Canal": the former covers the expense involved in riprapping with the larger rock from the shovel muck, the slopes of the fill into which the muck was wasted; the latter covers a portion of the expense involved in lowering some 12 to 18 in. the old bottom of the canal from the side bank of which the shovel was excavating. This material had to be drilled, blasted, and finally mucked by the shovel, and all these operations were properly charged to the ordinary operations of "breaking ground" and "machine mucking." But about one-half the total of this bottom yardage had to be hand mucked and piled up on the center line of the old canal section to allow the passage of trains and to act as a wall in preventing slides from covering the track when the bank was blasted. This hand mucking was unusual and in no way productive of progress; it was therefore deemed advisable to create a subdivision for it, which would make it possible to always eliminate that expense from the data in figuring new work.

That idea is characteristic of the whole scheme of analysis and subdivision of costs, i.e., to so separate and distinguish each minor operation involved in a piece of work as to make the data upon it complete. Everyone knows how infrequently one finds a second piece of rock work, dirt work, concreting, or even bridge work which is exactly like an earlier job. This argument is often used against the keeping of cost data at all. But with records segregated as outlined above, there need be no serious handicap in estimating. One can go to two or three (or more) previous contracts and pick from each rock work, dirt work, concreting, or even bridge work. For instance, data on minor operations, such as drilling, shooting or transportation, might be borrowed from the steam-shovel records and applied to work as dissimilar as car and trap or team work.

But the scheme of subdivision does not stop at naming and making complete the data for the various minor operations. These are again subdivided into more elementary operations where such subdivisions may seem useful. Thus the subdivision of the main minor operations above named would give the total cost and the cost per cubic yard of erecting the trestle from which the steam-shovel muck was deposited in the fill. But this would be of little value in checking up the efficiency of the carpenter force in erecting the trestle or in estimating the cost of another trestle. To be useful the records must show cost in terms of thousand feet board measure of lumber placed. Trestle erection expense items are therefore kept in a separate account besides being included in the steam-shovel excavation account, and the following subdivision of items made:

7. Trestle Erection
   (A) Mucking for Foundations
   (B) Carpentry
   (C) Materials

and the account shows costs in terms of thousand feet board measure placed.

Similarly in the matter of drilling, it is not sufficient to know costs in terms of cubic yards drilled as would be shown in the steam-shovel excavation account. One foot of hole may break a fraction of a cubic yard or many cubic yards and drilling costs vary as the length of the hole drilled. To be useful, therefore, drilling records must be in terms of lineal feet of hole drilled and, accordingly, a separate individual account is run for drilling outside the steam-shovel excavation account—one with its own subdivisions and showing costs in terms of lineal feet of hole.

Also in many other operations, e.g., "Transportation," the policy is pursued of encouraging the grouping of items on the report. Transportation is divided into operation expense and maintenance expense. No additional effort attaches to making such segregations and it accomplishes the twofold purpose of teaching the timekeeper to scrutinize and classify each item of expense closely, and makes the report read so plainly of the work as it progresses that frequent trips to the ground itself for information are unnecessary.

Besides the various income accounts there will always be connected with a piece of work certain non-income accounts, by which are meant accounts taking care of expense items which are not directly productive of progress. The following four non-income accounts are generally absolutely necessary.

(1) A Kitchen Account, to which is charged the cook and his helpers' expense and the supplies, and which should balance by credits from meals furnished.

(2) A Stock Account, to which is charged corral-boss, hay, grain, shoeing and other stock expense, and which should balance by credits from stock rental.

(3) A General Hauling Account, to which is charged the hauling of commissary and camp supplies and stock supplies, e.g., cement, steel, lumber, etc., and which should balance by credits from proper ad-

* Asso. Member of the Society.

ditional charges made for the materials when actually used.

(4) A Camp Equipment Account, to which is charged the expense of erecting and maintaining the camp, its water supply, etc., and which must remain unbalanced unless credited at the end of the job with the accommodation of the maximum number of men cared for by it, or unless prorated and charged by transfer to the miscellaneous expense item of the various income accounts.

Experience has taught so far that it is best not to attempt to make complete reports of the non-income accounts on the weekly reports but to insist on the timekeeper running separate accounts for each at the camp. It is not desired to confuse the weekly reports, which are mere summaries, with a mass of commissary detail. Accordingly, for the non-income accounts only the statements of labor expense are included; and in the matter of the income accounts, while the materials expense is also included, only the labor expense is extended forward into the totals column. This makes it possible to check up the monthly pay roll by merely adding up the extensions made for labor into the totals columns of the weekly reports.

Each contract superintendent is supplied with the necessary engineering assistance to set grade and alignment stakes, assist in plant layouts, and to report weekly progress for all departments of the work. This progress is incorporated in the weekly report before mailing to the central office.

At the central office these camp weeklies pass first through the hands of the chief engineer for a cursory examination to determine if proper classifications have been observed and to note any queries or remarks, for questions concerning charges and credits often arise. They are then turned over to a clerk, who works them up and enters them into the "cost book." In this "cost book" there is a separate sheet for each account, and it is so ruled that the data of each week are placed on a separate line, with figures for date, report number, progress, and expense for the various operations, each in a column by itself with proper heading. Then there is a final total column, in which is entered the combined cost of all the operations. These figures, showing in the proper column the cost for each operation and in the final column the combined cost of all operations, are made in black ink, and over them in small red figures is set down the cost per cubic yard, or other unit, cost as the case may be. (See the sample cost sheet.)

The clerk also makes out a "Weekly Cost Summary," which shows for each of the accounts the total expense to date, the total progress to date, the percentage completed, the average unit cost to date, and the unit cost of the work done the preceding week. This summary is made on a regular printed form in triplicate and one copy turned over to the contractor himself, one to the general superintendent, and a third forwarded to the contract superintendent.

The effort connected with this cost-data work is not so tedious or so expensive as one might suppose. On the smaller contracts, the superintendent is his own timekeeper and makes out his own reports. On the slightly larger contracts the superintendent is furnished with a timekeeper, who usually has had some slight engineering experience and who will be able to measure and report progress. On the largest contracts, besides the timekeeper, each contract, or if conveniently located each group of contracts, is furnished with an instrument-man competent to set grades, cross-section, or alignment stakes, measure and report progress, and do any one of the many little things which require some engineering experience and which if left undone will cost in a month's time much more than the instrument-man's salary.

On the larger concrete work an inspector is sometimes placed on that particular part of the work. He takes batch measurements of the concrete poured, reports daily the cement, sand, gravel, lumber, steel and other supplies and the labor used, so that each night the superintendent, who may have spent only a part or none of the day on that particular part of the work, knows exactly what his day's pour has cost. The advantages of such knowledge is not imaginary. In several apparently trivial matters many months' salary have been saved. The reports, when many contracts are in progress, require a considerable portion of one man's time for supervision only, a man who can be on the ground and in the office and see to it that proper classifications are made of all expense items and none overlooked. In the office, one clerk will have no difficulty in taking care of the reports from eight or ten contracts and doing much other work besides, such as checking payrolls, etc.

The exact value of the cost system would be difficult to determine, but it is nevertheless real. To know at all times just what every portion of the work is costing acts as a whip all along the line. A low mark in cost set one week encourages the contract superintendent to hold it there continuously, or if set by another contract superintendent creates a spirit of healthy rivalry. If costs are running high, additional efforts are made to reduce them. The general superintendent lends his aid and the problem is attacked from every angle until either a reduction in cost in accomplished or a revision of ideas thereon.

WEEKLY COST SHEET
(Original size, 5x8 in.)

$1798.12 Pay roll for'd.

Contract No. 9 — Week ending July 12, 1913

1. Account — Steam-shovel excavation
   - 22,855 ..... Cubic yards progress to date
   - $11,252.40 ..... Total expense to date
   - $0.492 ..... Cost per cubic yard to date
   - $0.312 ..... Cost per cubic yard this week
2. Account — Drilling for steam-shovel excavation
   - 23,432 lin. ft. ..... Progress to date
   - $1671.35 ..... Total expense to date
   - $0.071 lin. ft. ..... Cost to date
   - $0.067 lin. ft. ..... Cost this week
3. Account — Blasting for steam-shovel excavation
   - 25,940.0 ..... Cubic yards progress to date
   - $1305.99 ..... Total expense to date
   - $0.050 ..... Cost per cubic yard to date
   - $0.046 ..... Cost per cubic yard this week
4. Account — Trestle erection
   - 43.3 M. ft. b.m. ..... Progress to date
   - $1526.00 ..... Total expense to date
   - $35.25 M. ft. b.m. ..... Cost to date
   - Completed ..... Cost this week
5. Account — .....
   - ..... Cubic yards progress to date
   - ..... Total expense to date
   - ..... Cost per cubic yard to date
   - ..... Cost per cubic yard this week

WEEKLY REPORT OF LABOR
(Original size of sheet, 8½x14)

Week ending July 12, 1913 — Camp No. 12

Division	Rate per Day	S	M	T	W	T	F	S	Total Days	Amount	Totals Labor $1343.12 Pay Roll For'd.
STEAM-SHOVEL EXCAVATION ACCOUNT (Cont'd.)											
4. Machine mucking											
A. Operation											
1. Leverman	$6.66	0⁵	1	1	1	1	1	1	6⁵	$43.29	
2. Craneman	5.12	0⁵	1	1	1	1	1	1	6⁵	33.28	
3. Fireman	3.78	0°	1	1	1	1	1	1	6°	22.68	
4. Pitmen	2.50	0°	4	4e	5	5	5	3	26⁵	66.25	
5. Shovel rental	15.00	0°	1	1	1	1	1	1	6°	90.00	
B. Supply expense											
1. Fuel oil		15.75 drums @ $4.00								63.00	
2. Car oil		5.0 gal. @ 25c.								1.25	
3. Waste		4.0 lb. @ 12c.								.48	
C. Repairs and extras											
1. Blacksmith	4.00				1			0⁸	1⁸	7.20	
2. Mechanic	3.50				1	1			2°	7.00	
3. B.S. coal		.05 ton @ $26.25								1.31	
4. Hoisting chain										243.36	179.70
5. Transportation											
A. Actual transp.—operation.											
1. Dinkey driver	4.75	0°	2	2	2	2	2	2	12	57.00	
2. Conductor	2.75	0°	2	2	2	2	2	2	12	33.00	
3. Car dumpers	2.50	0°	6⁵	7	7	6⁵	7	7	41	102.50	
4. Dinkey rent	5.00	0°	2	2	2	2	2	2	12	60.00	
5. Car rent	.75	0°	18	18	20	20	19	17	112	84.00	
6. Track rent	2.50	0°	1	1	1	1	1	1	6	15.00	
7. Coal		7.14 tons @ $14.25								101.75	
8. Engine oil		2.0 gal. @ 25c.								.50	
B. Maintenance											
1. Track foreman	3.00	0°	1	1	1	1	1	0⁵	5⁵	16.50	
2. Trackmen	2.50	0°	2	2	7	5	5	2	23	57.50	
3. Blacksmith	4.00	0°				1	1	0²	2²	8.80	275.30

SHEET FROM THE GENERAL COST BOOK MADE UP FROM WEEKLY REPORT OF CONTRACT SUPERINTENDENTS
Small upper figures in columns denote costs per cubic yard. (Original size of book, 12x24 in.)

STEAM-SHOVEL EXCAVATION COST SHEET

Description of work—Canal excavation, 18 ft. base, ¾ on slopes, 70% earth, 30% loose rock — Work for—Gordon Land Co., by contract No. 9

Report No.	Week ending 1913	Sta. to sta.	Cu. yd.	Plant delivery	Superintendence	Breaking ground	Machine mucking	Transport.	Dump expense	Trestle	Misc. expense	Totals	Remarks
1	May 24			173.12								173.12	
2	May 31			362.35								362.35	
3	June 7			495.13	47.13	67.37				136.10	*346.17	1,091.90	
				120	078	290	267	170	111	1361	*593	2990	
4	June 14	216+50—217+20	563	67.20	43.86	162.60	149.71	95.60	62.77	767.47	*333.28	1,682.49	*Establishing camp and water supply
16	Sept. 6			596.15	12.70				14.70	13.18	*115.76	752.49	*Camp demolition
17	Sept. 13			392.67								392.67	
18	Sept. 20			225.45								225.45	
			55,348	2399.73	844.28	5613.33	4956.28	5369.81	1033.36	1684.18	913.50	22,814.47	Grand totals
				043	015	101	090	097	019	031	017	413	Cost per cu.yd.

(Black-face type indicates printed matter.)

BLANKS USED IN A CONTRACTOR'S COSTS-KEEPING SYSTEM

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, JUNE, 1914 Number 6

THE Bulletin of the General Contractors' Association is a highly successful, well edited and always interesting publication. Members of the Association and Advertisers who provide the "sinews of war" and their friends are kept cheerful by jocund comments or cajolery, relieved by a little humour here and there, although witticisms are more in evidence. We always read the same with interest. But those who differ from the views of that sprightly magazine are very liable to be treated with a sarcastic commiseration, which, in our humble opinion, is unnecessary and, often, unfair.

¶ In a recent issue, the Editor of that publication, referring to our Editorial of December, 1913, says we took the Association to task because their dues, $100 per year, are too large to permit a large number of contractors to join, and he concludes that "To those who feel their way about it, we most cordially recommend our brother association."

¶ The reason for this outburst is our endeavor to show that in order to be most effective, an association or organization, such as our respective Societies, needs not only money but above all a large membership, the larger the better so long as it is directed by men whose ideals are in harmony with the legitimate objects of such a body. And we, therefore, argued that high dues must limit the membership to men who are well able to pay the same, and such men especially among contractors are a comparatively small proportion of the men engaged in that uncertain and risky occupation.

¶ Our remarks were not intended to reflect on our brother. We simply stated a fact. We feel only friendship for those who are trying to do what we are also attempting to accomplish, and, anyway, we have no use for slurs.

¶ The Bulletin then says: "Another point in which we incur the displeasure of our neighbor is the legal regulation of specifications. We don't see the necessity for it." No trouble is taken to discuss our modest arguments, but the Editor pounces upon the one thing that gives him a chance to try to hold us up to ridicule.

¶ We do not think that we were referring especially to the General Contractors' Association when we stated that "You cannot legislate honesty in public officials is the favorable comment of those who do not think it wise to try to regulate and control conditions governing the award and execution of public works by legal enactment." Although a statement of that kind was made by the Secretary of that Association in a paper on the subject, we did not conclude that the same represented definitely the views of a large part of his Society since no formal statement of this kind had been made by that body. Furthermore, substantially the same words were used in an editorial in Engineering News, December 21, 1911, which discussed our proposed law. Again, we have heard practically the same words used so often by some of our own members who do not agree with most of us, that we are constrained to inform our esteemed and respected colleague that he has no monopoly on that expression.

¶ Anyway, we said we agreed with that sentiment except that since legislation does not make the burglar virtuous, it does not follow that we should neglect legal regulation of acts of public officials because they cannot be forced to remain honest. Then our sagacious critic had a brilliant idea. By distorting our meaning, he first makes it appear that we compare public officials and burglars. We know, as well as he does, that many officials are good honest men and they are the ones who are not in the least concerned by any regulations whose object is to merely make wrong doing more difficult. As for the other kind of public officials, will our kind friend show us wherein they are above burglars.

¶ Then says he: "And we weren't aware of any statutes regulating burglary. The Penal Code prescribes the punishment of that offense and for other crimes, including malfeasance of public officials." Now, we don't believe the writer of the aforesaid diatribe is so simple that he misunderstood our intention.

¶ Did we say anything about "regulating" burglary? Certainly not. Read again what we said brother. By the way, we judge that the Penal Code prescribes the punishment for that offense and not of the offense. It should be a great thing for the crook if the offense itself were punished.

¶ Our question: "What's the use of any law," was amended by our relative to read "What's the use of so many laws." He should have gone a step further. Many times people have been swerved in the performance of their imperative duty by that meaningless taunt "there is too much law." So long as we are witnessing every day the spectacle offered by looted corporations and public treasuries, and victimized taxpayers, it is idle to prate about "too much law." The trouble is: "too many bad laws."

¶ We are not so fanatic as to think that our proposed law is perfect. It is not, and it may not be a wise law, but we are seeking enlightment. At any rate we submit at least, some definite plan which may be improved and modified so as to produce something really beneficial. Instead of indulging in shallow strictures, why did not our contemporary dissect the proposed regulation and criticize its provisions. In that way, we would both learn, and have a chance to argue. It is a great pity that men who have the same general high ideals will fail to co-operate simply because they differ in their views as to the methods of securing the same. Meanwhile the crook and the thief have a chance to continue their looting and pilfering.

¶ After our friend of The Bulletin had relieved himself of the supercilious superficial speciosities aforementioned, he capped the climax by extracting a paragraph from our little talk on the subject and makes it look as though it had no head or tail. Perhaps he could not see the point or he did not want to. Or it may be that we, being so engrossed in the discussion, did not make ourselves clear to the reader. Anyway, let us take the blame.

¶ Nevertheless, it does not require great perspicacity to pick out a paragraph from almost any theme or discussion and make it look ridiculous. Obviously, unless the whole article is submitted, the reader is unable to reach a decision of his own as to its merits.

¶ As we write, we have before us a statement of the objects of The General Contractors Association and there is no difference worth mentioning between the purposes for which our respective Societies were organized, except that the former is local, while our organization is national. Therefore, it is a pity that we cannot co-operate in a friendly way instead of exchanging retorts.

¶ So far as we are concerned, our feeling is that should you, The General Contractors Association, ever need or wish the assistance of The American Society of Engineering Contractors in any cause that has to do with the prevention and elimination of the abuses to which contractors have submitted so long, you would receive our whole-hearted co-operation just as though your plan for relief originated with us.

¶ Blackstone says: "The business of the able lawyer is to bring the law abreast of the common-sense of the time; always remembering that the law is made for man, and not man for law." The law must always be tempered by reason, or we get tyranny and persecution, instead of security and safety.

Estimating the Cost of Buildings.

By G. ALEXANDER WRIGHT,* San Francisco, Cal.

The ever-increasing amount of unproductive time, and usually money, which contractors are called upon to expend in preparing, gratuitously, quantities, as well as prices, often for an owner's benefit, suggests that the time has arrived when all concerned should take up, and seriously consider, the possibility of adopting a modern and more sensible system of estimating, such, for example, as has been long in successful operation in older communities. Not a mere copying of such methods, for I advocate the creation of a standarized method of our own—an American system, practical above all things; a system that will be in line with our otherwise progressive building methods; a system that shall be clear and accurate, and that shall stand for square dealing between contractor and owner—in short, a system that shall give every man his due, no more and no less; a progressive system, free from the defects of other systems, such as unnecessary elaboration, and yet one that will reveal to the bidder, at a glance, the actual quantity of material and labor in a structure, in any individual trade. When bidders are invited to submit bids, they are theoretically asked of course to submit competitive prices, but in actual practice their bids are based upon competitive quantities, before the competition in prices commences; which, in my opinion, is as unjust to the contractor as it is ridiculous. A building can contain only a certain amount of material, and no amount of figuring by contractors against each other can make that quantity any more or less. Where, then, is the sense in a dozen or more general contractors competing against each other in taking quantities? One or more bidders, through being hurried, or being unable to take off the quantities accurately, leaves something out. What happens? Their bids are consequently low, and the owner benefits, at the low bidder's expense, whilst the competent or more careful bidder loses the job, because his quantities are more accurate, or because there may have been room for uncertainty when figuring the plans and specifications.

Not long ago, a general contractor (whom I have known over twenty years) told me that if contractors figured to do competitive work just exactly as plans and specifications called for, a man would not get "one job in fifty." Now, if this is true, and personally I believe it is, there is something very rotten in our methods. In my judgment it lies in our antiquated estimating practices.

Those of us who know something of the unsatisfactory conditions under which bidders are often obliged to figure, time after time without result, have realized that hundreds of thousands of dollars in time and money are taken from contractors' pockets evevry yea,r, simply because they do not, so far, limit competition between themselves to the matter of prices. They go on competing, and I suggest gambling, with each other as to the quantity of material a building will take, whereas I contend that that is a question of fact, and that competition in the quantities between contractors never can, and never will, in any way, change the fact that a certain fixed quantity of material and labor is necessary to do every job. There can be no legitimate competition in taking off quantities of materials, except that unfortunate competition which bidders make themselves when they take off too much, or, as too often happens, too little.

The legitimate competition can come in only where one man can handle a job better than another or one man may have some advantage over another in buying, and so forth, all this kind of competition is legitimate enough, but it must be obvious that no amount of figuring can reduce the real quantity of material which a building will take, and so my contention is that it would be proper and fair to start all bidders figuring upon the same basis, by furnishing each with a schedule, or bill of quantities, showing accurately and clearly the different quantities and kinds of materials which the bidder is invited to figure upon; and even then there would be plenty of competition left, in placing profitable prices against each item.

Our present method (or rather, want of method) in estimating, and the rapid strides being made in construction, are, as I have said, forcing upon the contractor, more and more every year, an increasing waste of time and money in figuring out quantities. This senseless waste of time and money in figuring out quantities. This senseless waste and competition cannot go on for ever. It has already brought men to bankruptcy all over the country, and has often prevented the making of a proper and legitimate profit among those who do succeed in keeping their heads above water.

This is a live question, and it deserves the earnest consideration of all contractors' associations and architectural societies from the Atlantic to the Pacific Coast.

No new or untried principle is involved. It is simply that of a definite quantity of work, for a definite amount of money. In substance the owner says, "I want this quantity of work done. The drawings and specifications show you how this quantity of work is to be assembled or put together: Now, tell me how much money will this cost? I want you to do the quantity of work called for; no more, no less."

At present, the successful bidder often says, in effect, to an owner, "I will erect your building according to plans and specifications," but—mentally—he says, "I do not figure that it will take as much flooring, concrete, plastering or painting as my competitors think it will!" Let me ask, Is this a proper or fair competition between contractors themselves? Is it fair to their own interests? There is only one individual who stands to gain anything under such imperfect methods, the owner, and not always he.

It may be stated that the Quantity System is equally applicable to engineering works, such as railroad work, sewerage disposal schemes, canals, pumping stations, etc.

Before proceeding to a further consideration of this subject, I may be pardoned perhaps for expressing the opinion, after having had over twenty years' intimate experience with the workings of the Quantity System of Estimating, and over another twenty years in San Francisco (without any such system), that I know of nothing in connection with the work of the contractor that would be more beneficial than the adoption of some equitable recognized system of estimating upon bills of quantities, and these latter would be equally valuable, whether sub-contracts were eventually let or not.

It is not the idea that we accept the methods of any particular country—the author hopes he is too much of an Ameriacn citizen to suggest that—but where contractors in older communities favor a certain system to the exclusion of the very thing we practice here, then I suggest that we might well stop for a moment and take notice of what is being done. For example, in the year 1909 a conference was held in Great Britain between the National Federation of Building Trade Employers, the Institute of Builders and the London Master Builders' Association, and a resolution was adopted recommending contractors who were members of these powerful organizations to decline to bid in competition against each other, unless bills of quantities were supplied for their use at the owner's expense. A deputation from these contractors' organizations afterwards attended before the principal body of architects, who promised to further the aims of the contractors as far as was within their power; and to-day the Quantity System is in full operation, not only in the case of private owners, but in all building work for government and municipal authorities, and upon the principle that it is impossible to obtain accurate bids without accurate quantities.

There must be some good reason for all this, and I suggest that it is worth consideration by any body of men, architects or contractors, who are endeavoring to get and to do better work, and thus elevate the building business to the honorable position which it is entitled to occupy, and to bring about such conditions as will cause owners to hold the competent architect, as well as the contractor, in higher esteem, and not regard him, as is too often the case now, with suspicion.

Now, let us consider, for a moment, a few of the disadvantages of existing methods:

*Member of the Society.

First—The time usually given for figuring is far too short for the accurate taking off of quantities, in addition to the pricing and figuring out of the many items. A bidder usually has contract work in progress, and other matters to be attended to during the daytime; other plans are to be figured by a certain time, and but little can be accomplished in the eight-hour working day, and so advantage must be taken of the night hours, sometimes all night, and even Sundays (as I hapen to know), and any other time. Only those who have worked under these conditions and over blue prints at night, hour after hour, taking off items, can appreciate the many difficulties, pitfalls, and liability to error through figuring against time, after the real work of the business day is over. But the plans must be returned first thing in the morning, or the bid must be in by a certain hour the next day. Nothing but hurry—hurry—hurry. In not a few cases more information is necessary; something is not quite clear. The plans and specifications do not agree on some point. Which is right? There is no time to find out, the only person who can enlighten you is asleep, perhaps, while the careful estimator is burning the midnight oil, and wrestling with problems which can be avoided and entirely eliminated under a more modern system of estimating.

Again, the careful bidder who honestly tries to get in all the items, and figures to do the work as called for, is frequently beaten by a less competent bidder, who forgets something, or who, maybe, is willing to take a chance anyway, in order to get the job. True, omissions in lists of materials are sometimes unavoidable, under existing methods, which unfortunately aim at speed rather than accuracy.

It is, to say the least, disappointing to a careful bidder on a large job to find his bid just above the lowest, and after the low man has signed up the contract, it develops that the painting, or some such item, was left out. This, however, could not occur with the Quantity System.

This is no overdrawn picture, as I know from personal experience. The competent bidder who gets in all his items to-day is usually under a disadvantage, unless he happens to be figuring against men of his own stamp. Meanwhile it would appear that the chances are in favor of the owner, most of the time, and it seems to be a case of "heads I win, tails you lose." Surely it is time there was a change.

The existence of present conditions, whilst much to be regretted, is due to a blind continuance of early-day custom. It is in no way up to date, nor conducive to progress, nor to that business success to which a bona fide contractor is entitled. It is entirely unsuited to modern construction and modern methods. The tallow candle, years ago, was a great invention, but how many of us would light our homes to-day by this method? And yet our estimating methods of to-day date from the same identical period as the tallow candle. Other countries have long ago graduated from such primitive methods, but we are content to stand still, and we are, in this respect, away behind the times. It seems to be almost inconceivable that shrewd business men are still willing to spend their time, all going over the same ground, figuring against each other on quantities, knowing all the time that they are all, save one (and sometimes even that one), simply wasting their time. By the adoption of some sensible system, all this quantity taking could be done by one competent person.

The great difference we find in bids arises, in my opinion, not so much in the prices or money values placed against the quantities, as it does from errors in the quantities themselves, the accurate preparation of which calls for special training and continuous concentration of mind, which the busy contractor of to-day can seldom find time to acquire.

Now we will investigate a bill of quantities, such as we are considering. What is it? and how is it used?

First of all, it is a document, handed free of expense to each bidder, lithographed or similarly duplicated, in order that all bidders' copies may be exactly alike. It will contain everything which it is essential for a contractor to know when making up a figure, with a separate section for each trade, such as excavation, concrete, brickwork, and so forth. A general summary is provided at the end of the bill, in which is entered the net cost of each trade; this summary is footed up ,the profit the bidder expects to make is added, plus the cost of the quantities, the result being, of course, the amount of the bid.

The methods of measurement must conform to the standards used by each individual trade, and through the bill the greatest care is taken to have everything systematized; all cubic, square and lineal feet, and numbers of items, will be found all together under their respective heads. In this way, immediate reference may be made to any item required, even though the entire bill may contain hundreds of items, and so every item has its proper place—nothing is left to chance. Detail sketches also appear in the margins whenever necessary, to show a bidder at a glance what is required. These, as we know, are of more value to an estimator than the long written descriptions one sometimes finds in specifications. The keynote of the Quantity Surveyor is accuracy. In going through the drawings and specifications he has come across all those doubtful questions which always crop up when figuring under present methods. He will have taken the mall up with the architect, and adjusted them, before the quantities are handed to bidders, so that everything is all plain sailing.

Nothing is "near enough" for a Quantity Surveyor—he scrutinizes every part of the work closely, clears up any doubts or anything capable of a double interpretation, and his work leaves no loopholes for either the owner, the contractor, or the architect to take advantage of The result is that it is seldom necessary for a bidder to ask questions of the architect when making up a figure. If he should wish to do so probably he would be referred to the surveyor, who is familiar with every minute detail of the work.

Further, and right here, lies one of the greatest advantages of the Quantity System. It is not necessary, except in a general way, for a bidder to study the drawings and specifications at all, and he certainly does not have to figure them. He simply prices the bill of quantities, and, in these days of hurry and bustle, this is as much as a contractor can be expected to do for nothing. This enables the competent contractor (the one who has unit prices at his finger ends) to make up a bid for, say a $100,000 building, in a few hours, and he has the satisfaction of knowing, when the unit price is placed against each item, that nothing has been forgotten; in other words, he contracts to furnish only so much material and labor—and surely this is absolutely right in principle. Good reasons exist why the general contractor should have faith in his own judgment and accustom himself to price items in every trade which goes to make up the building business. It is the only consistent method of estimating, for anyone who claims to be a general contractor. Experience has taught most competent men that it pays to do it. The mere getting together of figures from subbidders, and footing up the totals of the lowest, is not estimating at all. That is mere schoolboy work. However, I am led to believe that this is now the exception among general contractors in San Francisco rather than the rule. The ideal contractor is the one who makes up his own estimates, and not he who is dependent, for any reason ,upon sub-contractors, who thus become the real estimators. If every general contractor would keep a prime-cost book of all trades, and quantities were supplied to him, he would soon be in a position to give a fairly close figure upon any sized structure, without first taking sub-bids, and this I suggest is the most consistent, satisfactory, and profitable method to pursue, when bidding upon work as a whole; but of course it requires care and experience.

Further, one of the greatest arguments in favor of letting contracts as a whole is, of course, the fact that a general contractor has the ability to figure all trades in his own office, and that he knows how to, and will supervise the work of subcontractors, if any. If architects can be assured of this being done, it would be better for all concerned.

In general practice I believe the accuracy of the bill of quantities should be guaranteed. Such a document might well be made the basis of the contract, equally with the drawings and specifications; if this were done, the chief cause of disputes between owner and contractor would be removed.

This, I submit, is entirely logical and right—a certain quantity of work for a certain sum of money, the owner to determine the former and the contractor to fix the latter. Surely this is morally just and fair.

It may be asked, Where are these competent surveyors to be found? And it would be a natural inquiry, as it is no part of the duty of architects to prepare such quantities. In fact, the relation of the architect to the contractor should preclude him from having anything to do with furnishing quantities. This should be attended to by a disinterested specialist—the quantity surveyor. In older countries, young men of education are now apprenticed to practicing surveyors, and it has become a recognized profession. Years ago these quantity surveyors frequently came from the ranks of the architects; others possessing the necessary education were possibly contractors, building superintendents or estimators. I have known contractors' representatives who commenced life in the workshop, who, after securing the advantages of special training, made experienced and very competent quantity surveyors. There must be a beginning to everything, and doubtless there are many men in this country who, after some little training in the technique of

this work, should make reliable quantity surveyors. The principal qualifications are honesty of purpose and a knowledge of architecture and construction. The surveyor should be a neat draftsman and have actual experience in conducting building operations. He should possess the ability to readily detect discrepancies or conditions which might give rise to misunderstandings during construction, and last but not least, the necessary mentality to act disinterestedly. He must do what is right in measuring, as between the contractor and the owner. The usual custom is for the architect to furnish the quantity surveyor with a set of the drawings and a draft specification, and the latter then commences work in his own offices. During this period the architect and surveyor are in frequent consultation, to the end that all uncertainties are cleared up and adjusted upon the drawings and specifications. In short, no effort is spared to obtain perfect clearness and accuracy before bidders commence figuring.

Such uncertainties are bound to crop up; they are unavoidable. They nevertheless perplex the contractor when he is figuring, and his foreman on the job, and create unnecessary trouble and sometimes bitter disputes; and then, in such cases, one of the parties to the contract is usually a loser.

Now that we have briefly considered the qualifications of a quantity surveyor, let us take note of what the preparation of a bill of quantities involves. It may well be said that during the last forty years it has been brought to a mathematical science, and yet it is really surprising what a vague idea exists concerning the methods, objects and uses of the Quantity System. The fact remains, however, that, where the system has been adopted, responsible contractors refuse to figure without it. Some day that will be the attitude of contractors in this country—when they fully realize the folly of wasting their time and money in competing against each other on quantities as well as on prices.

But to return: Three distinct processes are involved, and each process calls for different operations.

First—"Taking off" and entering every item (or "dimension," as it is called) upon the dimension sheets. This is always done in exactly the same order, in every building; no dimension, however small, is omitted—no guess-work of any kind is permitted. The exact location in the building of every dimension taken is carefully noted, and every figure or note taken is carefully preserved for future reference.

It is impossible to illustrate here the work in detail involved in taking off each trade, but the following may serve to show the general idea: Let us follow a surveyor for a moment in taking off his dimensions for a few items of—we will say common brick work. He always commences taking dimensions at the same point on each floor plan; every length of wall from one angle to the next is measured separately and the dimensions entered in "waste," as it is termed. We will assume that it takes, say, fourteen dimensions to go clear around a building—these fourteen dimensions and their locations are permanently recorded, footed up, and the total lineal feet is then placed immediately below this, and a line drawn across the column to separate it from the next item. The dimension is squared, i. e., the number of square feet these figures represent is figured out, and opposite to the total we find a description, thus, for example: 21-inch wall of standard common brick work laid up with lime, mortar and Portland cement, gauged three to one, pointed with flat joints one side for whitewash and raked out the other side for cementing.

In good practice it might be best to give the number of square feet superficial of wall, and give the thickness. The same method is adopted with each story, with its varying thicknesses of walls, every dimension being entered in precisely the same order, with its particular location noted.

Then we come to deduction of openings. Those with inside and outside reveals (as in the case of box-frame windows) are taken separately, door openings the same. Those of one size and one thickness of wall are "timesed," as we say, and entered in the dimension column, so: "Ddt. 9/3 feet 9 inches x 7 feet 13 inch outside wall, fifth floor."

Then should follow an item, "extra labor," to so many 8-inch common brick segment arches in say three half-brick row-locks to 4-foot 6-inch openings with 3-inch rise in 8-inch wall, include for cutting skewbacks, etc., and for wood-turning piece and setting and striking. In case richer mortar was specified for arches, it would be so stated, and the proportions.

When rough cutting to brick work is required, every square foot of it would be measured. Brick work in footings or foundations, or walls below ground or at unusual heights, should be all segregated and given separately, with full descriptions.

Such items as the following are then taken by the square yard or square foot —viz., selected common brick facing. If joints are struck and cut (as face work), it is taken as a separate item, as should be the case with any portions that are to be pointed with special or colored mortar. Cementing by the square yard if on ordinary plain surfaces, but if in widths of 12 inches or under, then this is separated and taken by lineal foot; should this work occur on circular surfaces, it would be so described, kept separate, and the radius given. Lineal dimensions are taken of all rough splays and chamfers, flues, pointing to flashings, projecting courses, with the number of mitres, splays, or stops in same; brick sills, with the returns, are numbered, if any. The labor of forming quoins, square or splayed, and (in certain cases) the lineal feet of plumbing angles and reveals, might be taken, also leveling up for joists, bond iron and the like.

The foregoing applies to common brick work as before stated. Now, where "face" brick are used, the entire surface of each course, of which figured sketches foot, including reveals and soffits (but openings deducted), the kinds of mortar and the labor of pointing being given. Here would be taken such items as face arches. Fair cutting by the square foot on same principle as mentioned for common brick work. Then come lineal feet of each course, of which figured sketches should appear. Raking mouldings or belts separate; then follow the number of external, internal, raking, skew or other mitres; also square ends, etc. (if any). All other lineal feet items follow in their proper order, and then in a similar way, concluding with numbered items, which would be described and (if necessary) sketched in the margin. I am aware that this is but a very elementary illustration of the detailed method of taking off, but the principle applies throughout every department, in every trade, from the excavator to the painter, but it would be too great an undertaking to go fully into details here in each case.

Surveyors' quantities are usually measured net, and it is so stated in the preamble of the bill—upon the understanding that the unit price for each item is to be made, by the contractor, to cover trade customs, etc., which differ in each locality.

The before-mentioned dimension sheets are usually checked over with the drawings by a second person, and then all totals are abstracted; that is to say, they are transferred to abstract sheets, under separate headings. In this way many similar items of the same value are collected together and footed up and checked. This reduces the number of items which appear eventually in the finished bill, which is written direct from those abstract sheets, and any further sketches or descriptions necessary for the bidder to thoroughly understand what is required are then finally added. When completed, a sufficient number of copies of these bills are lithographed, or otherwise duplicated, and a copy is sent by the surveyor to the list of prospective bidders, whose names and addresses have been previously furnished him by the architect.

Some of the advantages of the Quantity System of estimating to the contractor are as follows:

1. Saving of time and money.
2. Greater precision in measuring.
3. No uncertainty as to interpretation of plans or specifications (the quantities should govern).
4. No visits to the architect's office when figuring, for explanations or otherwise.
5. No other work is contracted for except the quantity set forth in the quantities.
6. The contractor, if he so desires, can check up the quantities before signing a contract. In an American system of estimating, the quantities should, I think, form part of the contract.
7. No bidder can inadvertently leave out anything, and so in this way arrive at too low a figure.
8. Not having to spend time taking out his quantities, the contractor has time to attend to more profitable business.
9. Systematically arranged bills of quantities duly priced (whether work has been secured or not) form excellent data for making future estimates.

Before an American system can be put into operation it will be necessary:

First—That a committee or representative contractors be selected to standardize a method of measurement to be universally followed by all contractors and architects.

Second—That competent men, mutually satisfactory to contractors and architects, be retained in such numbers as the volume of work may demand. These men, or quantity surveyors, could be placed under bond, covering their competency and integrity, until they have been proved and assured; such appointments to be permanent, except for good cause; the compensation of these surveyors to be fixed at a certain percentage upon the total of each estimate; each bidder, of course, adding this amount to his bid.

Third—I suggest, also, that a law be passed requiring that a bill of quanti-

ties be furnished (free of expense to bidders) upon all State and other public buildings. I advocated this as far back as the year 1893, and it may interest you to know that such a law is actually in effect in the State of Pennsylvania, and has been since 1895. It does not, however, go quite far enough, as the quantities furnished have no guarantee as to their accuracy. Quantity question is attracting much attention at the present moment among contractors in Boston, New York, and other cities, and I may mention, perhaps, that a program is now being formulated to bring this Quantity System question to the attention of every building contractors' association and every architects' society in this country.

Fourth—In connection with the Quantity System I still advocate (as I did in a brochure on arbitration which I published in 1894) the creation of a technical tribunal, or court of arbitration, where nothing but building suits and disputes shall be determined and adjusted. (See also the American Architect, April 13, 1901.) Such court is to be presided over by a specially selected judge and at least two other persons of practical experience in the actual construction of buildings, and in estimating the value of builders' work, and familiar with building trade methods, terms, processes and customs. I maintain that such technical matters as building construction, values, etc., should not be decided solely by technical law, nor by laymen alone, however skilled in other ways, notwithstanding the custom of calling expert witnesses before them. I consider that it would be an advantage to disputants if a majority on the bench had a first-hand practical knowledge of building construction and methods, such as I have indicated, where technical disputes might be determined in a few days, once and for all, and without delays, which only tire the contractor out and thereby force him to accept settlement more or less unjust, from a practical standpoint.

I am hoping to shortly see a committee appointed in every building employers' organization in this country, to take up and seriously consider such matters as I have touched upon this evening. Nothing, in my judgment, will tend to elevate the building business and to promote a feeling of mutual confidence and respect between the architect, the contractor and the owner more than the Quantity System of estimating, which, as I think I have shown, aims at absolutely square dealing between the man who pays for the structure and the man who builds it.

Gentlemen, I fear I have kept you too long, but I hope there will be a full discussion of the subject. In what I have said, believe me, it is prompted solely by practical experience and a sincere desire to see better estimating methods adopted.

In conclusion, during a recent trip East and to Europe, it was my privilege, through your courteous secretary, to be kept in touch with your activity and the progress recently being made by this organization. I wish to extend to your president, directors and members my sincere congratulations upon the progressive methods you have so far adopted, and to tender you my best wishes for continued success.

I would like to add, as President Wilson is reported to have put it recently, that "nothing is done to-day as it was done twenty years ago." That is the essential fact. I read somewhere the other day that this age we are living in to-day is a new age, an age in which everybody all over the world is doing new things, with interesting, important, wonderful new devices, new methods, new machines to make new products; new proofs of the power of the human mind to conceive and to control, and the human hand to construct instruments with which to conquer the forces of nature and bring them to the service of humanity—these are the characteristics of the age we live in. Never have the creative forces of mankind moved so fast as in the lifetime of us who are now on earth. Never before have there been so many people in the world eager to know what the world is doing and how it is doing it.

Difficulties in Quantity Survey.

"One of the greatest difficulties ahead is the subject of standardization of measurement. * * * In drawing up a standard of measurement, I believe that two guiding principles should govern, although these may conflict with existing practices in many cases. The first rule is that all work should be measured net as fixed in the building, no allowance being made in the measurements for waste; that is to say, the quantity of brick work measured should be the net quantity that will be found in the finished building. The second rule is that material should in no case be measured to pay for extra labor.

"The question of difficulties to be encountered, what would happen if nine builders agreed to use the qauntities and the tenth refused? One of two things would happen. Either the architect could refuse to consider his bid or else the contractors using the system would have to bid under a certain theoretical disadvantage—that is, the disadvantage of carrying the quantity surveyor's fees in their bids. It is, however, probable that this would be offset by the greater accuracy of the quantities they figured on, and by the fact that it would not be necessary to add any profit for contingencies to cover any unforeseen expense, as a proper bill of quantities would cover all points and guarantee the contractor against errors of quantity."

It may be mentioned that Mr. Allen is a member of this Society also of the Boston Society of Civil Engineers and is connected with the Aberthaw Construction Co., one of the largest building construction companies in the East. He has given a large amount of time to studying this subject, which, coupled with his actual practical experience, places him in a position to discourse upon it in an intelligent and interesting manner.

It is claimed for this new method that it will be the means of securing more accurate plans and specifications for proposed buildings; more accurate bids from contractors; less cost to owners and fewer misunderstandings between those interested on the work and less of a gamble.

T. Hugh Boorman Resigns.

Mr. T. Hugh Boorman tendered his resignation as Treasurer of this Society at a meeting of the Board of Direction held May 5th, 1914.

In resigning as Treasurer, Mr. Boorman is automatically relieved of the duties as Chairman of the Membership Committee and as Secretary of the Philadelphia Branch.

Upon the suggestion of the retiring Treasurer, Mr. G. A. Unverzagt was appointed in his place, and is now formally performing the duties of the office.

The Problem of the "Four Corners."

Abstract from Lecture on "City Planning," By George A. Damon, Dean of Engineering, Throop College of Technology, Pasadena, California.

The prototype of the modern American city was the four corners of the country community. Here was the church, the school house, the blacksmith shop, the postoffice, and the general store with its cracker-box conventions. Many a city grew from such an "origin"—oftentimes in a haphazard way, but as the community developed and life became more complex, there was always a tendency to crystalize about separate centers,—for retail trade, for wholesale business, for education, for recreation, and for culture. The time comes in most cities when the desire for a civic center for public buildings finds expression and a need is felt for a comprehensive transit system which will conveniently unite all centers with the home.

A complete system of urban transportation with its "radial" and "circuit" lines will naturally locate, at intervals throughout the city, a number of subcenters which, in a way, resemble the "four corners" of our boyhood days. Unless there is some thought put into the control of these corners, the development will be about as crude as can be found in any provincial community. First comes a little tax-payer shack with perhaps a fruit-stand or a real-estate office. Then follows a cheap grocery, and as soon as the struggling proprietor shows signs of making a small living, he has a competitor and we have two inefficient stores in a district which should be served by but one good trading center. A shoe repair shop—then a feed store, perhaps a garage, and a collection of packing boxes combine to make the finest kind of an arrangement for not only holding down realty values at the corner, but for depreciating residence property in all four directions.

Now why not get our heads together and do things in a more intelligent, efficient and artistic manner? We already know the value of "restrictions" in city building. Suppose we formed a restricted district and agree to develop all four corners along the line of a preconceived plan of some architectural harmony.

Let one corner be devoted to a trading center with a limited number of stores, a market for fresh produce direct from the gardens, a branch postoffice, an express sub-station, office for real estate and insurance, a shop for a modiste, and such other business conveniences as the neighborhood demands. It even might be possible, by eliminating useless show windows, and by avoiding the usual "cubist" style of architecture, to make the commercial corner as attracive as the other corners.

In spite of the fact that some people do not believe in them, apartment houses appeal to a certain percentage of our population. But why not build them upon sites where the land values are low

enough so that some space can be used to furnish the setting of lawn and shrubbery? Let us say that one of our corners should be used for homelike apartments set a little way back from the street, and furnished with all the unique features of buildings of this class.

A "community club house" suggests itself for the third corner. I have in mind a house of this kind built in Winnetka, Illinois, where sixty-three separate organizations hold their gatherings in one common building. The boy scouts, the girls' sewing society, the ladies aid, the men's club, and many other local enterprises find here their home. Moving pictures three times a week, amateur theatricals, billiard and bowling tournaments, suppers, and socials make this building the social center of the community. A neighborhood church should find a home in this congenial atmosphere—for Wednesday prayer meetings, Sunday school, and Sunday services, perhaps conducted on an interdenominational plan, could be very handsomely provid-for in a building contiguous to the community house. Why not have a branch of the public library with a fine magazine room and a juvenile department convenient for both the church and the club house?

The last corner can well be dedicated to play,—not as a playground for the children, as it is too near the street car tracks, but for the older folks. In Pasadena we have what are known as "Tourist Clubs," where our visitors and retired residents meet for pitching horseshoes and matching their skill at chess and checkers. A favorite game called "roque" has reduced croquet to a science, while tennis can be played nearly every day in the year. We need permanent arrangements for these well established amusements, with rest rooms and lounging nooks, where one can find shade or sunshine as he desires.

If "city planning is a good business proposition," then this smallest unit in a city plan can be made to pay. I have in mind a certain "four corners," An acre of vacant land can be secured at each corner for from twelve to fifteen thousand dollars an acre, but prices are likely to advance rapidly. The community surrounding the corners needs all of the social, educational, recreational, cultural, religious and commercial advantages I have outlined. It certainly would contribute to the lower cost of living to do a little thinking, and secure the land before the influence of the ever working "unearned increment" makes a comprehensive development of the "four corners" impracticable. A little foresight now will have a marked influence on the happiness and prosperity of the entire surrounding district for all time to come.

Engineering Law

Edited by Thos. H. Ray,* of the New York Bar.

Performance of Contracts.

Generally speaking, where a contractor agrees to perform certain work for which the owner agrees to pay him a stipulated amount, it is an implied condition of the contract that the work must be performed before the payment becomes due. But owing to varying circumstances legal questions often arise as to just what constitutes performance of a contract by the contractor. These questions may take a variety of form. For example, can the contractor collect from the owner if he does too much work; or if he does not comply exactly with the specifications; or if the building upon which he happens to be working is destroyed before its completion; or if unforeseen circumstances prevent exact performance, such as strikes, bad weather or meeting with quick-sand in excavating. The question may then arise as to whether or not the complete and entire performance of the contract has been in any way excused.

Substantial Performance of Contracts.

When nothing is specifically stated to the effect that the contractor must perform his work before he is entitled to payment from the owner, a condition to that effect is implied by the law itself. The courts have made this rule for the purpose of doing justice between the parties and it is therefore necessary in each case to determine whether or not justice requires the implication of the condition that the contract should be completely performed before the owner must make payment. In other words the question which must be decided is whether or not the breach of the contract which is complained of by the owner as an excuse for his non-payment to the contractor is of so serious a nature that it should justify his entire refusal to make payment.

In this way there has grown up in the law a doctrine which is called "Substantial Performance of Contracts," and which is particularly applicable in the case of Building and Engineering Contracts. As is well known Building Contracts often embrace such a variety of detail that the contractor cannot always in spite of his best efforts literally comply with every particular of the specifications. It can easily be seen, therefore, that very much injustice would result if the owners were permitted to entirely defeat their obligations under the contract because of the failure of a builder to comply with the plans and specifications with perfect exactitude. Justice does not require that the courts should imply a condition in all contracts that the builder should be so held to perfect performance. Therefore, the courts have stated that the condition which they make part of the contract is not that perfect performance of the contract is necessary to entitle the builder to collect his money, but that the contract must be substantially performed in good faith.

Therefore, in determining whether or not a contract has been substantially performed the first question which arises is as to whether or not the contractor has acted in good faith in his efforts to perform the work. If he has made an honest effort to comply with the terms of the contract and has unintentionally and in spite of his best efforts failed in some small particular, he will generally be permitted to recover under the contract, although the owner will be entitled to offset against the contract price the amount which it will be necessary for him to expend in completing the work as the contract calls for.

Thus, the court states the rule as follows:—

"To constitute a substantial performance of such a contract, it must appear that the contractor, in good faith, intended to comply with the contract; that defects, if any, are not pervasive and do not constitute a deviation from the general plan, and are not so essential that they may not be remedied without difficulty.

Slight defects, caused by inadvertance or unintentional omissions, are not necessarily in the way of a recovery of the contract price, less the amount by way of damages requisite to indemnify the owner for the expense of conforming the work to that the contract calls for."

And again another court states the rule as follows:—

"The relaxation of its strict application in cases arising under the building contracts was not intended to permit courts and juries to substitute a money indemnity as an equitable compensation for unfulfilled covenants of the contract, but arose because of the difficulty of complying with entire exactness with all the particulars embodied in that class of agreements. Hence it has been repeatedly said in the decisions that it is only in cases where there has been no willful omission by the contractor, but he has honestly and faithfully performed the contract in all its substantial particulars, that he will not be held to have forfeited his remuneration by mere technical or unimportant omissions or defects."

But it must be clearly understood that the contractor cannot under the doctrine of substantial performance substitute his own ideas for those of the owner, alter the contract to suit his own convenience and then claim that he has performed it. He must comply with the contract. It is only where the variations or omissions can be supplied by the owner for a comparatively small sum with only such difficulty or inconvenience as is required in making ordinary repairs, that the contractor can claim that he has substantially performed his contract. Where the omissions and variations are such that they can only be remedied at great cost and then at risk to the building or other work, it cannot be said that the contract has been substantially performed. It is not sufficient, for example, for a builder to merely

*Member of the Society.

construct a house, but it is required that he should build the house contracted for and substantially comply with the specifications, as to the method of the construction, the materials and the workmanship, before he will be entitled to recover under the contract. And the burden of prooving that the defects are immaterial and also of showing what the cost will be of remedying such defects or omissions is placed upon the contractor.

Thus in a recent case arising out of the performance of a building contract the court laid down the rule as follows:—

"A building contract, like any other, is to be fairly performed according to its terms, and any substantial change, unless authorized by the owner, or architect, is made at the risk of the contractor. In order to avoid injustice the law tolerates unsubstantial deviations made in good faith, but it exacts full compensation therefor, and permits a recovery on the theory of substantial performance, only after the proper deductions have been made. The contractor had no right to substitute his own judgment for the stipulations of the contract, or to recover on the basis of complete performance, when, as the court found, he willfully and intentionally used inferior and less expensive materials in the place of those agreed upon. When the owner stipulated for iron pipe he had the right to iron pipe, regardless of whether some other kind, according to the opinion of the contractor or of experts, would do as well. He agreed to pay upon the condition that iron pipe was used, and he is not obliged to pay unless that condition is performed."

Usually the question of whether or not a contract has been substantially performed so as to entitle the contractor to recover the contract price under it is one of fact and the issue has to be determined by the jury from all the facts relating to the performance of the work which should be laid before them. However, when the defects complained of pervade the entire work it may then become the duty of the court to take the question out of the hands of the jury and to rule as a matter of law that the contract has not been performed. Thus, in a case where omissions to an extent exceeding ten (10%) per centum of the contract price was shown it was held that such a failure prevented a finding of substantial performance and a ruling as a matter of law that the contract was not performed was a proper one.

(To be continued.)

Accounting Department

Conducted by Harry M. Smith*, Certified Public Accountant, New York.

The following article which appeared in the March, 1914, issue of "The Manitoba Engineer," under the caption, "Some Notes on Cost Keeping for Contractors," was written by Mr. G. L. Shanks, a member of this Society. That the writer knows his subject from practical knowledge is obvious, if only his first paragraph were considered. Fortunately the articles continues beyond that and contains much that may be read beneficially by those interested. It follows in its entirety:—

Second only to the ability to lead and manage men, cost-keeping is the most vital and important element in modern contracting. Granting a contractor average skill in handling men and the technical affairs of his business, his success in future contracts will usually depend on how closely his office system allows him to estimate the cost of the different elements in the work at hand. An important point to note is, that while it is often fairly easy for those in charge to study out and plan in detail a comprehensive scheme for cost-keeping on any job, it is a different matter to make the subordinates live up to the system. Most of them fail to realize the cost analysis end, i.e., the calculation and study at certain intervals (usually every day or week) of unit costs for different items, such as mixing and placing concrete, driving piles, excavating rock, etc., and the application of these derived costs to discover and correct at once any weakness in the methods of doing the work.

The main divisions in cost-keeping on construction work are: (1) The direct charges for labor and materials, and (2) the necessary expense charges incidental to the work—often called overhead charges. These expense items, unless watched and controlled by a firm hand, are liable to total up to a large sum, and may often be the deciding factor in the financial failure or success of a contract. They include, among others:

(1) The salaries and travelling expenses of the superintending, engineering and clerical staffs on a job—also the current operating expenses of the job office.

(2) Charges for plant rental (if any), installation, maintenance, and dismantling.

(3) Building and operating a boarding camp, if there be one.

(4) Liability insurance, if any be carried.

(5) Transporting, unloading and storing construction materials—such as fuel, cement, sand, gravel or crushed stone, brick, lime, lumber and timber, piles, reinforcing steel, stone masonry, etc., etc., if the cost of these cannot be directly charged to some unit in the work, such as a pier for a bridge, or a floor for a building.

The division of the direct labor cost on a job into the different charges or subdivisions should be done most carefully. Above all else, these charges should be practical and flexible, i.e., they should be finally decided on only after a thorough study of the actual conditions at each separate job, and they should not be so numerous as to make the system stiff or unwieldy. In short, cut the number of labor charges down to an absolute minimum, but make sure that each separate charge gives maximum service, and is sufficiently flexible so that it may be either subdivided or expanded, if necessary. It should be constantly remembered that these cost records are kept for two main purposes: (a) As a RECORD, and for use on future work—hence they should be accurate, well arranged and easy to understand; (b) As a CURRENT CHECK on the efficiency of the work, and as a sure method of detecting any leaks or weak points in the organization or methods employed—hence they should be kept strictly up to date. The cost clerk or timekeeper, whose duty it is to collect and classify all this data, should have a wide practical knowledge of constructural engineering, and a sound judgment, as it is sometimes necessary to differentiate cerefully between various charges.

A material clerk should be held responsible for all the hand-tools and supplies on the job—his duties to include the ordering of material, the checking of the material on arrival, and the storage of same when not in use. He may sometimes include heavier items, such as heavy plant, large timbers, etc., in his work, but on large works these are usually supervised directly by the contractor himself, or by his superintendent or engineer.

There should be, as a rule, only one storehouse on a job. All hand-tools in everyday use, and all perishable supplies (except explosives, gasoline, oil, etc., which are always stored separately) ought to be kept in here under lock and key, and a careful check made of all outgoing and incoming material. Very often, in cases of emergency, supplies, tools, etc., are needed in a great hurry, and it seems hardly necessary to state that the interior design of the storehouse ought to receive careful study. The most commonly used items should be kept nearest the counter or door, and all shelves, bins, stalls, hooks, etc., should be so placed that they may be reached with the least possible motion, and the contents in or on them handled with minimum effort. These are but elementary principles to follow in order to obtain the highest efficiency, yet they are commonly disregarded.

It would be advantageous to keep two books in the storeroom: a stock book and a material charge book. The former should be a complete and up-to-date inventory of all the tools, supplies and material in use on the work, the different quantities being corrected at least daily. It may be urged that a card or loose leaf system would be just as good, if not better than a book. There is not much difference between them, the chief advantage in the use of the book being that it is more compact and affords a better chance to study and compare the variations in the use of the different items entered therein, since the stock quantity is corrected daily from the start of the job, and the amounts of the different items are all together, instead

* Asso. Member of the Society.

of being scattered on various individual cards which easily get misplaced.

In the material charge book all the outgoing supplies and materials (except the hand-tools, which are charged against the men using them) are charged against the different units in which they are used, such as the various piers or pedestals in a bridge, or the different floors in a building. It is not absolutely essential that entries be made in this book every day (the sooner the better, however,) as the book is not usually needed until the structure is finished. Then, indeed, it is valuable.

The supply of iron rods, bars, flats, tool steel, etc., used by the blacksmith is, of course, kept by itself close to the smithy, and all that seems to be necessary with this item is to enter in the stock book every time a new supply is received, so that the working capital, as it were, is known at any time. It seems to be unnecessary to book up from day to day the comparatively small amounts used up, as the blacksmith can always be consulted as to the standing of any single item, and as to when any new supply is needed. He reports to the material clerk, each day, the quantity used, and what units it is to be charged against.

With regard to pipe-fittings of all sizes, valves, etc., it would seem to be better to correct the stock book from day to day, so that a close check can be kept on the stock, and needed material ordered ahead of time—the lack of these small fittings, at critical times, often causing serious inconvenience and delay. All outgoing material is to be charged to the different charge heads, as before.

Supplies in current use, such as nails, spikes, washers, rope, oil, etc., should be booked up and charged out as closely as seems practicable and reasonable. Naturally, the standard of refinement on other portions of the work will govern the standard of the office work in the storeroom. For example, it would not pay to be severely economical in the use of nails, as the carpenters might thereby be induced to turn out inferior work, and yet, on the contrary, money may be literally thrown away if some vigilance were not exercised over the nail supply. The oil question is another one which might be discussed in the same way. There is a happy medium which can be reached in all these things, and although it is sometimes rather hard to educate the employees to appreciate the economical ideals of the management, it is possible, and is certainly a goal to be aimed at.

Hand-tools, rain-coats, rubber boots (if supplied at all) and similar articles which are used and kept by the men, personally, ought to be handled somewhat differently. In the stock book should be kept a list of the total stock received from time to time and supposed to be on hand. It does not seem necessary to correct the stock book any further, because all the otugoing boots, coats ,tools, etc., will be charged up to the different men personally. A loose sheet or notebook may be kept to enter up daily the hand-tools, such as hammers, wrenches, peavies, crosscut saws, etc., which are taken out early in the day, or at various times during the day, and brought back in the evening. All hand-tools should be returned the same day they are taken out of the storeroom, and any not returned ought to be charged against the man taking them out.

Employment Bureau

Men Available

Actuated by a desire to be of direct assistance to all its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on the file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

006 Superintendent with twenty years' experience in heavy construction operations, competent to handle large jobs successfully. Good organizer, now open for engagement. Considered a hustler. Any location. Age 43. Practical experience in installation and operation of cableways, shovel, pile-driving and such apparatus. Member of the Society.

007 A neat little organization with $2,000 to invest, consisting of a competent ESTIMATOR, with four years' successful record (Member of the Society) and a superintendent mason, and a carpenter with four years' success in handling concrete work, desire association with an experienced contractor with sufficient financial resources. Write to the Secretary for further particulars.

008 Charter Member of the Society. Employment desired with a railroad company on maintenance of way, revision or appraisal work, or position with a construction company. RECORD: Civil Engineer. Twelve years' railroad work as Transitman. Engineer. Roadmaster. Engineer of Maintenance Way. Last five years and at present a member of a construction company engaged in heavy foundation and reinforced concrete construction.

009 Member of the Society. Student graduating as Civil Engineer in June, desires position with construction company. Would prefer work in charge of concrete gangs. Has had two summers' practical experience in concrete work as follows: Bent and placed reinforcing rods, run a concrete mixer, charge of concrete gang. Handled the instrument, laying out buildings, giving lines and grades and figured quantities of materials required.

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The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, JULY, 1914 Number 7

WHY NOT ALWAYS AWARD THE CONTRACT TO THE LOWEST BIDDER?

THE award of a contract to anyone but the lowest bidder should be inferential evidence of the honesty of the award rather than the opposite. Thus concludes the writer of an editorial in "Engineering and Contracting" of June 10, 1914, which we reprint in this issue. (See page 75.)

¶ On the other hand, Major Cassius E. Gillette who has had considerable experience in the investigation of public contracts said in a paper before this Society; "Nothing in contract work has been more abused than the privilege reserved to the official to reject bids for reasons existing in his discretion."

¶ These two views are severely at variance. Who is right? Let us see.

¶ The writer of the article first mentioned above states that: "The engineer in charge is best qualified to judge of the sufficiency of a bid and of a contractor's qualifications." We don't think so. Neither did Mr. H. P. Gillette, who is editor in chief of "Engineering and Contracting," in the matter of the award of the contract for the Ashokan Dam.

¶ In that case, the engineer in charge decided that the low bidder could not profitably do the work at his figures and the contract was given to a higher bidder at a cost of some two million dollars more to the City of New York. The principal item under consideration was the earthwork. Mr. H. P. Gillette, who knows a good deal about digging and moving earth, testified that the specified amount of soil could be dug and moved profitably for the unit price bid by the low bidder of whose financial responsibility there was no question. Nevertheless, the judgment of the engineer in charge prevailed. Who was right?

¶ Is the decision of the engineer to be based on the financial means of the contractor, or on his previous experience. Suppose he has a wealth of experience, but limited means, must his bid be rejected? Many contractors who were not rich (although most of them are, according to newspapers) have been able to carry through profitably contracts at prices below that of all the other contractors bidding for the same work.

¶ If this is not the criterion, must it be decided that, if the contractor is rich but has no experience, he is not entitled to the contract? If he has not the experience himself, he can, of course, associate with him men who have the requisite experience either as partners or as subordinates, and if he is a good business man, he may be more successful than the more experienced contractor who depends on himself alone.

¶ Yet, there is much in favor of the awarding of the contract to the lowest responsible bidder. If the engineer, or other awarding official could always be depended upon to decide the matter impartially, or to have the requisite knowledge of the various factors that make up a contractor's qualifications, the decision might well be left to him. We believe however, that there is a better way than to depend on the discretion of the official.

¶ How can the public interest be protected against the failing contractor, the crooked contractor, or the contractor poorly equipped, etc.? Not only by the requirement of a good and sufficient bond covering all the prints involved, but also by providing that such bonds shall be accepted only from surety companies that are known to make good in case the contractor defaults on the contract.

¶ A bonding company is in a far better position to investigate the financial responsibility of a contractor, his previous experience and other qualifications, than any engineer can possibly be.

¶ A prominent architect in Chicago makes it a rule, for instance, that no bids will be accepted by him unless the surety bond to accompany the bid will be furnished by one of two or three companies named in the specifications. Since this architect has adopted that policy, he has never found it necessary to complete or re-advertise any work started by a contractor to whom the work was awarded at first.

¶ The general tendency is to require a certified check or else to require too small a bond. In Indiana, the practice is to require a surety company bond equal to the contract on concrete bridges, and twice the amount of the contract on gravel roads. No certified check is permitted. This is a step in the right direction and these requirements seem to be none too high.

¶ It is, of course, too much to expect that either policy, viz: engineer's judgement vs. good and sufficient bond, will be perfect, but one of the two methods is better than the other. We think the bond requirement is. Under proper restrictions this would mean that the lowest bidder and the lowest responsible bidder will be the same person or firm. We should like to hear from some of our readers good reasons why we are wrong.

Committee on Quantity Surveying

PRELIMINARY REPORT.

Gentlemen:

Your Committee has had under consideration the system of Quantity Surveying and its adaptability to conditions in the United States. It is not prepared at the present time to submit a full and final report, but wishes to place before the Society some general preliminary observations in the hope that these may produce valuable results.

I. Definiteness is of the first importance in every contract. Both parties should know as exactly as circumstances will permit the obligations of each. So far as uncertainty can be eliminated from building and engineering contracts, the contracting business will be placed on a more solid, and less speculative basis. Bids can consequently be lower because percentages for contingencies can be omitted. The gain by making contracts certain, will benefit both contractors and owners.

II. At the present time the risks undertaken by contractors are too uncertain and too great. The gambling element is too large in every contract. Conditions unforeseen by the bidder on any large contract may under present methods cause enormous losses, even bankruptcy. The most careful contractor does not know what may be the outcome of the best considered business plans.

III. Uncertainty must continue to exist in construction contracting, where the nature of the work to be done is not, or can not be disclosed until, for example, excavations are made. Now, the contractor must take all the chances, the owner none. New problems frequently arise, for the solution of which experience gives no positive guide. This is the greater reason for making every effort to remove uncertainties, wherever possible.

IV. Present estimating practices are now generally admitted to be inaccurate, risky, wasteful of time and energy, all eventually leading to disputes and lawsuits. There are no fixed standards of estimating, no authoritative methods. Each contractor and sub-contractor estimates on his own individual interpretation, with more or less understanding of the meaning of the plans and specifications. Differences in bids usually arise from mistakes and the varying conceptions of what is required, made by bidders in estimating. The lowest bidder is usually the man who has made the largest mistake. Existing methods are loose and uncertain. Results are correspondingly uncertain.

V. Differences frequently arise between the general contractor and the sub-contractor or the specialty contractor growing out of existing estimating practices, because there are unmethodical, uncertain, and unstandardized. Prompt payment should be made every contractor or sub-contractor for the actual quantity of work properly performed. This is often impossible in the absence of proper methods and of proper standards in specifications, and in estimating. Better standards should be created and permanently established.

VI. The accurate measurement and description of prospective work under an engineering or building contract requires experience, time, and skilled training. It should be undertaken by one person, specially qualified by training and experience in quantity surveying. When the bills of quantities are made, they should form the basis of the contract between the parties, by which both should be bound. If this is done, the owner knows how much work he has a right to demand of the contractor and the contractor knows how much he is expected to give. It should not be subject to the direction or the caprice possibly on any individual. The result will be that each contractor will stand on the same basis in bidding, and that the cost of many "contingencies" will be excluded, which now help to swell the total in an estimate.

VII. Your committee believes that this can best be accomplished by the adoption of the general system that a quantity survey should precede every contract and that this be made the basis of the contract. This involves the employment of specialists, in other words, quantity surveyors." This work should be done by them in preference to non-experts. Their compensation should be paid by the owner in some form.

VIII. It is true that at the present time, some engineering contracts are let on unit prices which are in some degree a rough form of quantity surveying. But such unit descriptions seldom, if ever, tell the contractor all he has to do, and there is as much gambling when pricing such deficient units as there is where no quantities at all are supplied. Plans and specifications are made by some engineers (and architects, too,) apparently with the idea of making as little trouble as possible to themselves, thus throwing the difficulties, uncertainties, and responsibilities upon the contractor. The contractor in a unit price contract necessarily determines his unit price by distributing his overhead costs over the number of units called for. If this number is greater or less, his remuneration for his general overhead costs is increased or decreased. The unit price contract should therefore be based upon approximately close (not widely divergent, contingent) quantities. The contract should provide for a proportionate increase or decrease in the contract price, in case the quantities are exceeded or reduced. On this basis, all percentages charged for uncertainties can be excluded. The risk of loss if the quantities are below the estimate will be avoided. Unbalanced bidding will be greatly discouraged, and largely eliminated.

IX. In developing a system of quantity surveying, whether in lump sum or unit price contracts, the quantities should be sub-divided into trades and the description of each item indicate the actual work to be done. Thus, the concrete work and forms should be measured separately; excavation should be qualified, whether in the wet or dry, and according to its depth; rock excavation should not be measured with earth, nor to the net lines; but to the quantities estimated necessary to be removed, in order to reach the net lines. Sheet piling, cofferdams and other elements essential to the execution of the main work should all be separately measured. Fixed uniform standards of measurements must be adopted and maintained in each trade, and they must fully represent the work to be done.

The contract price, whether for lump sum or for unit prices, should be based upon a full consideration of every detail. This is not an impossibility. The result will be a saving to the owner and a removal of risk to the contractor.

Your committee feels justified in emphasizing the great principle of square dealing, involved in the quantity system of contracting. In our opinion it provides the most efficient time and labor saving method for estimating and building purposes, whether the work of engineering or architectural in character.

Respectfully submitted,

G. Alexander Wright, Chairman,
(San Francisco, Cal.)

William B. King,
(Washington, D. C.)

William L. Bowman,
(New York City)

Leslie H. Allen.
(Boston, Mass.)

Looking at the other Side.

The other day the Governor of the State of Idaho, two ex-Governors, the Mayor of Caldwell, bankers, professional men, merchants, and well-to-do citizens generally, to the number of 300, donned overalls, shouldered picks and shovels and sallied forth to do a bit of road work in the neighborhood of Caldwell. It must have been a grand and inspiring sight to see these men with soft hands and untrained muscles going valiantly to show by their works their faith in the good roads movement, and incidentally to garner a bounteous harvest of blisters, sunburn and backache. It is safe to say that not more than five per cent. of those volunteers was efficient or even practiced in the handling of pick and shovel. That is, fifteen of them could do a full days of effective work without going to the hospital afterward, and the other 285 just cluttered up the ground and were more or less in the way. It also is a safe guess that the one day of work represented as costly a bit of road-building as has been done anywhere in this land of wasteful effort. Taking the average earning capacity of the volunteer shovelers and pickists, in their own vocations, at ten dollars a day—certainly a conservative estimate for such men—the cost of that one day's work, in wages alone, was $3.000. Fifty practiced and efficient shovelers could have done more and better work in the same time and at a wage of only $150. But we must have spectacle and hoorah, brass band and tinsel, or we feel the entertainment committee is not doing its duty. It would not have been enough like a show for the governor, et al, to make up a purse of $3,000, hand it to some competent road-maker and ask him to get the most for the money. For example, $3.000 would have paid the highest of wages to the fifty expert shovelers for twenty days. Yet, with such spectacular, inefficient, wasteful, and unbusinesslike exhbitions before us every day in all parts of the land, we wonder why we do not get more substantial results from our taxes and other expenditures, and why it costs us so much more to live than it did our fathers.

Training Men for your Organization

Trained men in any line of endeavor are a necessity—and likewise a scarcity—and as contracting is both a business and a profession the need of such men is emphasized. Anyone just starting into contracting has the need of trained men brought forcibly to him, while large construction companies always are on the lookout for men of this kind.

Men ,to be of value, must be not only trained but ambitious and competent. Such men need only be known to be in demand, and can command large wages; for in the end these men are the cheapest. Their mistakes are few and inexpensive; and besides, from their training they are enabled to devise many new labor-saving methods. It is the cheap, inexperienced man that is expensive.

There is a need to-day for teaching engineering contracting in our colleges; for if contracting is a science, as is claimed by some, then it can be taught, and there is a growing demand among young engineering students to take up this branch of engineering.

However, a course in college and a degree will not make a contractor, any more than it will an engineer; but as in the case of an engineer, it gives a good technical foundation upon which to build, and supplies the means to fit a man quicker for his life work, as it allows the young man to profit from the experience of others, assimilating from others the results that would take years to obtain in his own career. The case is analagous to that of a man who spends months to calculate that he could secure in some handbook for a few dollars.

But whether a man has a college training or not, he must still go through the practical training in order to become proficient Even if he never becomes an expert, at least he must be so well trained that his work will be efficient, and he can be relied upon by those who employ him.

This subject of training fen is being given much thought and attention in the twentieth century. Many of the large commercial organizations have come to realize the value of trained men—not only trained to their particular line of business or profession, but also to their own particular methods and systems; and they are therefore devising apprenticeships and training courses so as to no longer be dependent upon chance to pick up efficient men.

The railroad companies are also beginning to realize that it is necessary to train men, instead of waiting many years for men to get the experience that will fit them for operating officials. Within the past decade one of the ablest railroad financiers and organizers came to the conclusion that it was the wrong principle to wait until a man became 45 or 50 years of age before he was competent to be made a superintendent, for he may then have only from 10 to 20 years of usefulness before him. So this man began to experiment with picked young men, to try to train them for such positions in from three to five years, so that they might become operating officials, and possibly more efficient ones, before they are 30 years of age, when they have before them a career of from 30 to 40 years. Not every man selected stands the training, nor do all who go through the course measure up to the standard; but the venture may be termed successful and the results obtained have justified the methods to such an extent that other roads are copying them.

One mistake sometimes made by organizations that are now training men is to take it for granted that a large per cent of the young men selected will not make good; and going on this principle but little help is extended, so that many actually do fail. Thus money must be expended to train or partially train a much larger number than is needed. It may not be wrong to tell the young man starting that the majority fail, as this may act as a spur to him and put him on his mettle to make good; but it is absolutely essential that these young men be not only trained but assisted and guided and a watchful eye kept on them. Man has never devised a machine that did not need some attention in order to keep it running; and so it is with the human machine—if success is to be obtained, watchfulness and attention must be the price paid.

As it is possible to train men in commercial lines and in railroad operation, so it can be done in the contracting field, and men can be made efficient managers within a comparatively short time.

First, there must be a standard set for the selection of the men to be trained. Such a standard need not necessarily be high as to education, although the broader a man's education, the more likelihood of his being successful. However, the standard should be high as to the applicant's character and natural ability. As a rule the man should be unmarried, of good health and habits and of a bouyant disposition. But hard and fast rules for selecting must be deviated from at times; for the exceptional man will appear, who if accepted may prove quick at learning and be ready to take up difficult tasks many years before others can be trusted to undertake them.

The contractor doing a limited amount of work can train men just as well as those operating on a large scale; in fact, better, for the young men will come directly under his care, and not be trained by a subordinate who may have little interest in the proposed scheme. He, too, is as much in need of trained men as his larger competitor, especially if he hopes to expand his business.

It is useless to train men and then not treat them so as to retain them in the organization. The course that they are put through will make them valuable in a much shorter time than if they "just growed" as Topsy did; hence if they can earn money much more quickly for their employer, they themselves must be paid salaries commensurate with their earning power. Many contractors seem to overlook this fact, gauging the salaries they pay, not so much by the earning power of the employe but rather by the salaries others pay men of about the same age and years of experience. Thus as men are trained and become valuable they leave to go with other contractors who are willing to pay according to the value received from their men.

One firm of contractors that has advanced by rapid strides within the last 10 or 15 years owes much of its success to the fact that the head of the firm has the ability to select good men as managers, and he pays such salaries as to attract them, and as they come to know his ways and methods, and prove their value to him, he keeps their salaries at a high standard, until today he has a larger staff of high salaried men and is paying higher wages than almost any contractor in the country. This really accounts for his success. By keeping his men satisfied he has held the same staff for years. The earnings of such men more than offset their salaries.

The selection of a course of training will vary somewhat with each contracting organization, just as the courses for the same degree vary in our leading colleges, but the general studies and methods can be the same.

First of all, the man to be trained must have some knowledge of mathematics. The more training and the greater the knowledge he has received in this line, the easier will be his other work; for applied mathematics is the foundation of all professions except those of belles lettres. Arithmetic, proportion and algebra are absolutely essential, while geometry and trigonometry will be found a great advantage in solving many problems. Elementary mechanics should likewise be studied, and the general principles of electricity. If the applicant has not had this course of training he should be sent to a night school, put under a private tutor, or given a course in a reliable correspondence school.

If anyone should ask the writer upon what side of contracting most contractors are weakest, he would not hesitate in saying the clerical or office end. Therefore, he would start the young man in that part of the work. The accounting should be the first thing to tackle. He should not only be taught the methods, but the reasons should be shown for using these methods. The routine work is the small part; he must obtain a clear understanding of the entire system. From this he should be given the task of making up special reports, to show the application of all clerical work. The gathering of such statistics will give him a comprehensive knowledge of the entire subject of contracting. This once obtained, he will be able to take in the details much better, and this recording and rehandling of the details will then be the next step.

The writer knows that many will differ with him as to this; but from experience and a close study of successes and failures in contracting, the writer does not hesitate in asserting that those trained in the general principles first and then made to cover the details, get a broader and more comprehensive training and their rise is more rapid. It must be remembered that the training of clerks and bookkeepers is not being considered—these start with the simple details and work up; but rather the men who are to handle important contracts, the future general managers and partners.

The next task should be the time keeping, the making up of payrolls, the handling of the workmen's individual accounts, and the actual paying off of the men. This will bring the beginner into first close touch with the vast army of industrial workers. He will get to know these men from their worst side—the grasping of money, whether it has been earned or not; he will learn the petty deceits, and the frauds practiced by foremen to obtain money for themselves, both from the contractor and his employes. He will be impressed with the importance of having these things correct and of keeping the men satisfied. In all of this work supervision must be given the man, but he must be placed on his own resources and made to rely on himself. He should be taught not to worry his superiors with useless questions, but to find out things for himself; but it will be well to explain to him the underlying principles of everything he is given to do.

At this stage he should be shown the importance of supplementing his work with reading. He should follow articles in the contracting and engineering journals, the proceedings of societies, and read books covering contracting and engineering in a general way. This reading should be kept up the rest of his life; and later when he gets to handling construction work, he

should read books on the various classes of work being done, as concrete, excavation, sewers, railroads and other construction. These books should be referred to from time to time.

After time keeping, he should handle cost keeping, and the collection of all cost data. Then he should be taught the analyzing of costs and the use of cost data. This will give him an insight into estimating and the methods of doing work and the building up of a contract system and organization. He will learn of the various classes of work, their units, the sequence of events in carrying on construction, and many other details that will prove of value in the next steps of his training.

From cost keeping he will go to the first work that will bring him into intimate touch with actual construction, that is, the handling of supplies and materials. He will receive and check materials and supplies. In doing this, more so than in cost keeping, he will learn prices and see the need of closer buying. He will learn of wastes and how to prevent them. He will, if he keeps the proper records, get to know how much of each kind of supplies are needed weekly or machines and different classes of work. He will begin to learn of the care and repair of machines and tools.

In handling materials he will learn that the work of men is dependent upon receiving regular supplies of the materials, of the proper storage from the weather and to prevent them being rehandled uselessly. He will be brought face to face with executive problems, and not only how they must be solved but how to devise expedients to overcome unexpected delays and difficulties. He will now be an important part of the organization, the success of the entire job depending upon him. In receiving and handling the supplies and materials he will have his first experience in handling the men and teams that must work under his direction. This will be valuable experience for him, for he will get to know men, and as his forces will be scattered and difficult to watch he will need to use his head to keep them busy and know they are following instructions.

This might be termed his preliminary training and it will cover a period of from one to two years.

The next step begins the real training for construction work. A small ditch has to be excavated to let off some rain water, or some similar job needs to be done, and the young man is given a small crew of men and set to work as foreman. This done, he is sent with his crew to assist some foreman, and he becomes a sub-foreman. Here he learns to obey, for no man is fitted to command others until he has learned obedience himself.

From sub-foreman he is sent with an extra gang to do odd jobs, his men being changed frequently so he will learn that different individuals must be handled in a variety of ways. From extra gang, he is given the foremanship of a gang doing some hard, monotonous work, where he will experience the daily routine grind of doing some difficult task, that will ordinarily take the heart out of the average man.

Then as occasion arises he can be given a job where he may have to handle several forces and rely much on his own judgment. Thus by changing from job to job and from one class of work to another he will gain experience under different general managers and on various kinds of work under many different conditions.

On some new job he can be sent out as assistant to the man who is to run the work. Here he can help to plan the job, organize the forces, assist in buying machines, materials and supplies and learn much that will benefit him. From this he could be given some small piece of construction to start and superintend himself, where he will have to keep his time and cost keeping, do his bookkeeping and buying, run his gangs, and in fact be everything that a small contractor must be, in order to make both ends meet. Here will be his supreme test; and if he makes good he will go on with his work, working mostly under others, unless he shows exceptional ability, until he learns how to estimate, plan out jobs and start them, and finally take charge of large undertakings.

Many young men selected will fall by the wayside. Some will have to be dropped soon, others will never get beyond the office work, making only good clerks; others will master these and some of the outside details, while a few will go through the entire course, making first-class trained men and amply repaying for the time and money spent on all of them.—*The Contractor.*

Better Estimating Methods Are Coming.

In many quarters there has arisen serious unrest as to conditions imposed by the wording of building contracts, comments the Quantity Surveyor, in its last issue. Much has been said and written on the subject. Objection has been raised to certain existing alleged abuses and, which we think, is more or less justified. But to look at these things squarely, money is of course the root of it all. Cost, profit, bills, pay rolls, these are the principal forces which stimulate the buyer and the seller; the owner and the contrcator. Nothing we can do will ever bring about such an ideal condition in building transactions probably, as to eliminate all dissatisfaction, but a great deal can be accomplished in the way of bringing about by one side or the other (jointly is much to be preferred), some method of regulating the element which enters so largely into the money end of things, viz., the cost—estimated or actual.

Nothing will effectually check the desire to get the most out of a deal, whether it occur upon the part of the owner or the contractor, but we do suggest that this desire may be kept within measurable bounds. In short, if the contract is based upon more accurate and equitable grounds than has hitherto been the case, the results must surely be improved and be a benefit to each party. If the owner on the one hand can have put before him something which will (apart from drawings and specifications) show him "how much he is getting for his money," and the contractor is on the other hand guaranteed that he will not be called upon to furnish a greater quantity of materials and labor than the owner has agreed in detail to accept in return for the contract price (as obviously would be shown by a contract bill of quantities) then we eliminate uncertainty and bring the deal, which a contract really is, down to a business basis. It is a mistaken idea to imagine this will stifle or limit competition. It will do nothing of the kind. True competition will on the contrary be stimulated in a healthy manner. The personal equation, the executive ability of the intelligent contractor, his skill, his very qualification, financial and otherwise, will be more concentrated towards doing a good job under the quantity system because it assures a good prospect of a legitimate money profit (not a surplus or shortage of material) and of which cash profit he should not be deprived through error by an antiquated custom which compels him to figure quantities in time, all too limited, just because an owner wishes it, or because he imagines that the quicker he can get over the figuring period, the better deal he will make. Contractors are to blame in having for so long tolerated, and perhaps permitted, this one-sided proceeding. Most things come to an end, at some time, and the end of the time when the contractor must shoulder all the risks, all the responsibility is approaching more rapidly than some of us realize. United action among the leaders in the builders exchanges throughout the country would clear the way for we think that, as a class, the architects are ready for better methods.—

S. W. Contractor.

The Perfect Specification.

That there is a lawsuit in every building contract (at the pleasure of the parties concerned) is an accepted axiom; hence, the contract is a document that is usually drawn up with considerable care and legal minds are not infrequently requisitioned in its preparation. When it comes to the specification, however, laxity is more honoured in the observance than in the breach. The classes are strung together one below the other, with but little regard to what has gone before or what is to follow. Repetition and tautology become wearisome, while an infinity of unnecessary detail prolongs the length of the document beyond the bounds of necessity. The fact is only too often overlooked that the specification is as much a legal document as the contract; indeed it forms, with the plans—and for the matter of that with the correspondence that ensues—a part of the contract, and the two must stand or fall together. Specification writing must be regarded as an important branch of the work of the engineer and the architect, and it is difficult to understand how the lamely-worded, halting, ungrammatical documents that one only too often sees can come from the pens of men whose calling presupposes the receipt of a fairly advanced education.

Clearness, brevity and consistency are the three things to aim at in writing a specification. Lengthy sentences of necessity become involved, and the snappiness of modern journalism may be followed with advantage. Reiteration of descriptions of similar work and materials does not, as is commonly thought, add strength to the document; and, too, there is ever the danger of dissimilar clauses on similar matters creeping in, to the confusion of all parties concerned. Tautology is to be avoided if possible, but true literacy excellence is not to be attained and an expressive word or phrase had better be used over and over again if to ring the charges on it would mean any danger of confusion of ideas.

A general clause to the effect that everything shall be done in the best and most workmanlike manner will save an infinity of that needless description of working processes which, to use the words of an authority on the subject, is often carried "to the verge of absurdity." Words such as "proper" and "sufficient" have practically no meaning at all, and the writer should avoid them by stating clearly and concisely what is proper and sufficient. Small detail sketches may be introduced in the margin with advantage, not necessarily as saving description but as helping to elucidate it; but even these may be overdone and "carried to the verge of absurdity" unless the writer places due restraint upon himself. "The description in specifications of workmanship and material of the highest class in positions which any practical builder knows to be unreasonable and unlikely to be insisted on," says the authority already quoted, "leads to a general system of discounting the written requirements by the experienced estimator, who tenders accordingly, and at a much lower rate than

his deluded competitors, who weakly suppose that the specification means what it says." To sum the matter up: If the specification drafter clearly understands what he is writing about, says exactly what he means and not a word more, clearness, brevity and consistency will have been attained.

Many books have been published giving complete specifications or specimen specification clauses for both building and engineering works. Used with judgment such books may prove of the greatest service; but there is ever the danger of irresponsible consultation and the extraction of clauses which may, when strung together and read as a single document, have all the bad features that have been referred to above. Stock clauses to fit the requirements of every class of work cannot be drafted, and the architect or engineer who dabbles in such things may court serious trouble with his clients. Every clause must have precision of application, for incertitude is fatal. The wide tendering of which so much is heard is due largely to the atmosphere of uncertainty which attaches to many specifications. Two men may read a badly framed clause in two different ways, three men in three different ways, and so on; whereas a properly drafted clause should be of so definite a nature that it could convey but the one meaning, and that the meaning that it was intended by its writer to convey. Specification writing might, in fact, be reduced almost to an exact science, free from ambiguities and uncertainties, and offering no scope for the exercise of the "speculative" mind. Given a brief, clear and consistent specification, and a full set of quantities (with, of course the necessary drawings) and the tenders of a score of competent men need not vary to a greater extent than five or six per cent. As things are, fifty or sixty per cent. is not uncommon.—*The Contract Record.*

In Defense of the Engineer.

It is not often that in a public document a defense is made for the engineer whose work has failed. Some months ago there was a partial failure of three bridges in the Philippine Islands. An editorial appeared subsequently in the Quarterly Bulletin of the Philippine Bureau of Public Works, written by Clarence W. Hubbell, chief engineer. The following abstract of the editorial was made by the Engineering News:

It is obviously impossible to hold the individual engineer financially responsible for mistakes or failures. A single error of judgment on his part may cost more than his entire salary of a lifetime. Nor is it customary in any part of the civilized world to hold a professional man financially responsible. A captain loses his ship but he does not reimburse the owner for the loss, nor does he lose his standing as a captain unless investigation shows him to have been negligent in his duties. The average lawyer must of necessity lose at least 50 per cent. of his cases; but he does not reimburse his clients for their financial loss even though their cases may have been lost through his ignorance or incompetence. The doctor loses many cases; but he makes no financial reimbursement for his mistakes, though he may lose both prestige and practice if his mistakes are too frequent or too well known. Architects and engineers are required to design fireproof structures; but no one would think of holding them financially responsible for damages caused by fire.

There is a curious popular misconception that engineering is an exact science and therefore an engineer should make no mistake. Nothing could be further from the truth. As well say that because the rules for computing interest are exact the business man should make no mistakes or failures. In fact, the very engineering formulas used for computing the size of a beam, the flow of a river, or the bearing value of a pile are based on assumptions that are only approximately true and in some cases may be as much as 50 per cent in error. The results obtained by their use depend entirely on the skill, experience, and judgment of the engineer who applies them. He must select the constants to be used just as a business man must from his general knowledge decide whether a certain enterprise will pay 2 or 20 per cent on the investment.

An engineer pits his training, experience, and skill against the unknown in nature. His structures must stand against flood, typhoon, earthquake, fire, and decay. In addition to these unknown quantities he must also provide against the uncertainties of imperfect workmanship, variable character of materials used, and the vagaries of foundations, as well as the use and abuse to which his structures may be subjected during their life.

In the beginning, engineers untaught by experience and unskilled in technical knowledge provided against all unknown factors by building structures five, ten, twenty, or even a hundred times as strong as they really needed to be. In those days expense was a secondary matter. In the present day, from a business point of view, the best engineer is the one who can secure the largest useful return per dollar invested.

The general public should understand that it requires no engineering skill to build structures of such enormous proportions that there is no possibility of failure. It does require engineering skill, however, to so design and plan structures as to get reasonably safe and satisfactory results with the least amount of expenditure.

It takes no small degree of courage for an engineer to assume the risks necessary for true economical design and construction, knowing as he knows that the probable failures incident to such a policy are likely to bring upon him an unintelligent and unjust criticism, which in the case of a young engineer may even ruin his reputation. It is the province and policy of the Bureau of Public Works as an organization to protect its engineers from such unjust criticisms. This does not mean that incompetency, gross errors, or ignorance of correct principles will be condoned. It does mean that legitimate business risks intelligently assumed will not be held against any engineer in the service.

The Lowest Bidder and the Lowest Responsible Bidder.

An editorial published in the current news section of this journal of Feb. 18, 1914, called attention to the fact that the lowest bidder and the lowest responsible bidder on a piece of work are often different contractors. An illustration was given in which the mayor of a small town insisted that a certain contract be awarded to the lowest bidder, although the engineer in charge suggested that the bid be rejected because it was obviously and very much too low. The mayor carried his point, the low bidder was awarded the contract and, owing to the lack of the requisite experience and working capital, soon abandoned his contract. The bondsmen, relatives of the contractor, refused to take up the work and suit had to be brought to compel them to do so. This, of course meant a long delay in completing the work and heavy court costs. After the contractor abandoned his contract it was learned that he was an undertaker who, during a dull season in his business, decided to take up contracting as a side line. The editorial mentioned concluded that: "If some municipal officials would give less thought to the possible saving of a few dollars in the contract price and would devote more consideration to ascertaining if the bidder had sufficient capital, experience, ability and plant to carry out the work, there would be fewer 'undertakers' taking up contracting as a side line."

The foregoing rather extreme case serves well to illustrate one of the greatest faults in the application of the contract system of doing public work, namely, the awarding of contracts to lowest bidders who are not properly qualified to carry their contracts to successful completion. This evil is becoming better recognized and there is a growing tendency to award contracts to the lowest responsible bidder rather than to the lowest bidder. Theoretically this has always been the case, but actually the vast majority of contracts for the building of public works have been awarded to the bidders submitting the lowest bids regardless of their other qualifications. This practice has been by no means limited to small towns or even to municipal works; in fact the practice has been all too general.

The two quotations which follow indicate the growing disapproval among engineers of the practice here condemned. In discussing a paper on the state supervision of dams and reservoirs, presented before the New England Water Works Association, Mr. M. O. Leighton, chief hydrographer of the United States Geological Survey, in part said:

"Consider the contractor. It is undoubtedly true that many dam failures have been caused by poor work on his part. You know the predicament of a contractor who is losing money on his job, and how easy it is to consider the fact that he is losing money and therefore to allow a little indulgence here and there. To secure a good piece of work under such conditions, eternal vigilance is usually necessary, and few of us measure up to eternal vigilance. One of the best ways to obviate such a difficulty is to abolish that absurd and antiquated regulation which prevails, especially in public work, that the contract shall be awarded to the lowest bidder regardless of the cost and the difficulties and regardless of the real responsibility of the man. In 90 per cent of the cases, and probably more, the expense, trouble and delay caused by a defaulting contractor who is awarded a job at too low a price, more than exceeds the difference between the successful bid and the rational one."

Plans and specifications insure good construction, as a rule, only under rigid inspection. Mr. Leighton's comments bring out a point which should be more generally appreciated by those who award contracts, that is, the human element must be considered in its relation to the rigidity of inspection when a contractor is losing considerable sums of money. The responsible contractor is one who will do good work even though at considerable financial loss to himself, but this type of contractor seldom bids too low in these days of basing bids upon carefully prepared contractor's cost estimates.

In his latest annual report, Mr. Charles A. Finley, superintendent of the Pittsburgh bureau of water, comments as follows upon the folly of awarding contracts to the lowest bidder, regardless of other considerations. To quote:

"The unfortunate and unwarranted delay in some of our new work calls attention to the necessity of more rigid determination of the ability of bidders to execute the terms of contracts. These delays have arisen from lack of management. The provision in our specifications, that the bidder shall have the necessary organization, capital, experience, etc., to execute the terms

of the contract, should be made to mean just what it says. The fact that a bidder is the lowest bidder should not secure for him any consideration unless he had demonstrated the ability to execute such a contract.

A competent contracting organization is just as essential to satisfactory results as is the engineering organization which designs and supervises the work."

Mr. Finley specifically names three of the most noticeable and annoying examples of delay in the completion of contracts in the recent experience of the Pittsburgh bureau of water. He states that in each of these cases bids were received from contracting organizations which had demonstrated their ability to comply with the progress required in the contract. They were not the low bidders, but in each case the city has lost money by awarding to the low bidders.

The popular adherence to the low bid regulation undoubtedly comes, in part, from the belief that a higher degree of honesty is present when contracts are awarded to low bidders rather than to relatively higher bidders. There are evidences that this simple faith is passing. Enough stories exploiting the smart tricks of those who graft on public works have been published in the popular press during the past few years to impress upon the more intelligent of the general public that if a disposition to graft is present the low bid regulation is easily surmounted. The public should now realize that the awarding of a contract to a high bidder for the purpose of "getting in" on the difference between his bid and the low bid is regarded as case A-sub-one among the simple forms of double-dealing under the contract system, and as much too crude a method to be employed with safety. So well is this ancient form of grafting understood that awarding a contract to anyone but the lowest bidder should be inferential evidence of the honesty of the award rather than the opposite.

The engineer in charge is best qualified to judge of the sufficiency of a bid and of a contractor's qualifications. If he sees reasons why the low bid should be rejected he should not hesitate to recommend that it be rejected.

Contractors Plant—Hand Tools.

Contributed by Howard J. Cole.*

One of the losses bound to occur on all contracts is that on hand tools and small supplies, most of which disappear through theft or bona-fide loss, and therefore should be a direct charge on the job.

On small contracts it is customary to keep this class of tools in the tool box into which they are usually thrown promiscuously and from which mess they must be rooted out each day. A little attention to an arrangement of racks, etc., in the tool box for various classes of the tools will result in the tools receiving better care and a saving of time when searching for any particular tool; for there will be a place for everything, and everything should be in its place when not in use. A rack should be built for shovels so that they could be placed in it, blades upward; crow bars and similar tools can be kept on brackets or shelves near the top of the box so that when needed, one would not have to overhaul all the contents of the box. Provision having been made for the tools most in use by the above means, the remainder of the box is left for ropes and other space taking equipment.

A list of the tools sent to the job in the first instance should be tacked on the inside of the tool box cover for the information of the foreman, who, thus has a constant reminder of the tools furnished him and can add to it as time goes on, giving him a check on the out-nt that he should have.

All tools should be branded on their metal portion andalso on the wooden portion and in addition to the handles of the more common tools; shovels, picks, etc., should be painted with the contractor's standard color. This has been found to produce excellent results, especially in situations where several contractors are working on the same job; as one can readily identify his own tools at a glance, without looking up the brand which very frequently is so mutilated as to be obliterated.

All tools should be cleaned before being put away, especially the shovels, barrows, etc., used in concrete work. In some cities the laborers furnish their own shovels and it is interesting to note that they take particular care of their own tools, but when the tools are furnished by the contractor they are very negligent, unless compelled to be careful. All tools should be returned to the storehouse at the end of the shift and the watchman should make a tour of the job at the close of the day and pick up mislaid tools.

On large sized contracts it is well to have a separate building for tools and storehouse purposes under the charge of a handy man, or else have the storehouse located close to the office so that it can be looked after by the office force. A good arrangement is to have the storehouse and tool room in the rear of the office building with an entrance through the office and another in the rear which is kept locked except when tools are to be given out. These buildings should be so arranged that every tool has a place. An orderly tool house with everything arranged systematically will be found to save not only the tool loss but also be a great convenience to all concerned especially around inventory time.

An inventory should be made of the tools sent to the job at its start and addition made to the same when any tools are received afterwards (about on the following lines):

Article	On Hand Jan. 1, 1914	Bought	Total to Mar. 1, 1914	Actually on Hand	REMARKS
Axes	12	6	18	16	2 lost in coffer dam
Adze	6	—	6	6	

This should be made out in triplicate—one copy of the home office, one for the superintendent and the other for the storekeeper.

Thus it is possible for the superintendent to order tools in advance (especially if these sheets are kept up to date by the storekeeper) and avoid the trouble of waiting for tools that are ordered at the last minute. This is not so important when the job is in or near a large city where one can get in telephone communication with the hardware man and get quick delivery; but on the out of town jobs it is vital, for unless there is always a good supply of tools and fittings to draw from, it may be necessary at times to shut down portions of the work and wait for deliveries of supplies or tools which would have been avoided by an inventory and a little foresight.

The proper arrangement of racks, shelves, etc., must be studied out for each job; but a good general rule to be followed is to place the tools most in demand nearer to the door and the heavier and cumbersome ones in as handy a location as possible, always leaving an isle wide enough to roll a full coil of rope with ease. The wire rope reel should be raised on supports so that it can be easily revolved and located opposite an opening for ease of measurement, etc.

*Director of Society

Construction News.

Pendleton, Oregon: Mr. Arthur S. Bent, President of the A. S. Bent Construction Company and Director of this Society, writes us that they are making great progress on the contract for Pendleton Water Supply, which comprises about 16 miles of 26 inch, 24 inch, 20 inch and 18 inch concrete pipe, bringing a new water supply from Springs at Thorn Hollow to the Pendleton City Reservoirs. The contract amounts to $135,000 and was let last fall. It is now nearing completion. Pipe making was carried on during winter by using a large grain warehouse heated by hot air furnaces. The pipe line follows a contour, except for eight siphons, amounting to about three miles. These are under heads of from 35 to 90 pressure, and are built of 24 inch reinforced concrete pipe, made in three-foot sections, with a shell only 2½ inches thick. The pipe line is designed to carry 5,000,000 gallons in 24 hours.

Middletown, Ohio: The Hackedorn Contracting Company of Indianapolis, of which Mr. Hillis F. Hackedorn, First Vice-President of this Society, is President, have received a contract to build the bridges and viaduct on the levee road on the Great Miami river west of Middletown, Ohio. It is the largest piece of bridge work in the Miami Valley, made necessary by the ravages of the Easter flood of last year. The flood emergency commission, the county commissioners and the engineer have been giving all plans submitted with bids two weeks ago the most thorough and careful scrutiny with the result that it is believed that of all the plans submitted they have selected the very best type.

The construction is to be reinforced concrete throughout, with a brick paved roadway 23 feet 8 inches wide between curbs and a six foot cantilever sidewalk along the south side. The rail along both sides of the bridge is ornamental cast concrete, with molded spindles of an artistic design. There are to be twenty artistic cast reinforced concrete electric light standards which will carry large opalescent globes and they will be illuminated by 100 Watt Tungsten lamps. These standards will be placed on the pier posts in the rail on both sides of the bridges. The old channel nearest Middletown will be spanned by a semi-circular arch of forty foot span. The present channel of the iron will have a three span bridge, the center span being one hundred feet clear opening and each of the end spans 94 feet 6 inches.

At the point where it is intended to have the new channel cut through a five span bridge will be placed with the following clear openings: 94 feet, 100 feet, 108 feet, 100 feet and 94 feet, and at each end of this principal bridge the viaduct construction will be placed, which will consist of ten spans ranging in length from 70 feet to 94 feet, the shortest opening in the entire iron structure will be seventy feet, which precludes the possibility of trees, lodging between two piers and blocking water way during extreme high water.

All of the arches are semi-elliptical in form, commonly called "flatarch" construction and have the highest possible springings so as to give the maximum waterway.

The total length of the combined bridges and viaduct is 1921 feet, which assures the people of Middletown that never again will they suffer from backwater in flood times on account of the obstruction of the levee.

The Hackedorn Contracting Company are pioneers in reinforced concrete bridge construction and have built many of the best and most artistic bridges in the country, which is a guarantee that the Middletown work will be of the highest standard. Equipment and materials have been ordered by telegraph and work will be started immediately.

Levis, P. Q., Canada: The Lauzon Engineering Company, Ltd., Engineers and Contractors, of Levis, P. Q., of which Mr. Harry Paquette, member of this Society, is Managing Director were awarded the contract by the City Council for the paving of Laurier Avenue and Commercial Street. The paving is to be done with the Medal vitrified paving block.

New York.—For the information of our New York friends who are interested in our efforts in aid of the Quantity System of Estimating, but who for any reason are non-subscribers, we may mention that a complete file of the "Quantity Surveyor" may be seen at the New York Public Library (Astor, Lenox and Tilden Foundations) Fifth avenue. The New York representative of the American Institute of Quantity Surveyors is Mr. J. R. Wemlinger, Secretary American Society Engineering Contractors, 11 Broadway.—*The Quantity Surveyor.*

OBITUARY.

Robert C. Dewar of East Orange, N. J., a member of this Society, was killed Wednesday, May 20th, in the collapse of caisson on Pier 8 of the new Washington Street bridge work, So. Norwalk, Conn. The accident occurred while Mr Dewar was inside the caisson which caved in, immediately killing him. The real reason for the failure of the cofferdam has not as yet been determined.

Mr. Dewar was the Chief Engineer on this work for McHarg-Barton Company, and has been a Junior Member of this Society since 1911. The following is a brief outline of his record:

Born, Sept. 2, 1887. Graduate of Cornell University in 1909 as Civil Engineer. Superintendent for American Concrete Steel Company on the construction of Scott-Browne factory at Bloomfield, N. J., Hudson Hat Co. factory, Newark, N. J., and Bayonne High School, Bayonne, N. J In the Fall of 1910, he became associated with the McHarg-Barton Company of New York as Superintending Construction Engineer in charge of erection of Hospitals on North Brother Island, Felchbury Viaduct, Felchbury, Mass., and construction of the Washington Street bridge at So. Norwalk, on which work the accident occurred. He was a member of the Cornell University of Civil Engineers and many other organizations.

The Percentage System in Electrical Contracting.

By C. D. Crain, Jr.

One of the most important and interesting developments in the electrical contracting business, as in other departments of building construction work, is the use of the percentage system. As the name suggests, this plan involves awarding business to the contractor on a basis of an agreed percentage above the cost of labor and materials.

The defects of the system of bidding are obvious. In the first place, there is an element of uncertainty which sometimes results in the contractor handling an important job at an actual loss. Unforeseen elements of difficulty may arise, and the delay and increased expense thus made necessary eliminate all possibility of earning a profit.

The average owner is willing that the contractor make a fair profit on his work; and it is also plain that if a contractor sees that he is likely to lose money on a job he will be tempted to "cut the corners" wherever possible for the sake of making his net loss as small as possible. This does not always happen, of course, for many concerns would rather lose money on a piece of work than risk losing the good-will of the customer. Nevertheless, the temptation to slight the quality when it is found that a bid which is too low to cover the cost has been made, is present, and it doubtless has its effect in a good many cases.

On the other hand, the very fact that the wise contractor appreciates the risk involved in bidding, since it is never possible to anticipate every feature which may arise, means that a larger margin must be allowed to take care of the unknown quantities than would be necessary if every point were covered by the bid. The contractor who would be willing to make 15 per cent "for sure" on every job will probably allow 25 per cent in bidding in order to cover the unexpected difficulties that may arise, and also to take care of other jobs where the net had been considerably below the expected profit.

That means that in some cases the owner pays more than a fair price for the job. He is helping to average up the general run of work, and his excess payment offsets the too small amount charged on an unprofitable job. This is obviously an inequitable system, and furnishes a legitimate argument for the use of the percentage system.

One of the chief advantages to the contractor is that he can get the benefit of accumulated good-will and the prestige which goes with a record of big jobs well handled. While it is not necessary that the architect let the contract in every case to the low bidder, the inclination is always in that direction, and thus the inexperienced and the unskilled, who know neither how to figure the cost of a job nor how to handle it to the best advantage, are likely to get work to which those who have proved themselves in previous jobs are really entitled. That is one of the glaring weaknesses of the present system. The lowest and best bidder is the man to whom the contract, in theory, should be awarded, but in actual practice it is the low man more often than the best who gets the business. Contractors have learned this, and know that only when their bid is pretty close to the bottom will they be given serious consideration.

The percentage system eliminates all this. It puts a premium on efficiency and high-grade work. If the Johnson Electrical Company did an excellent piece of work in wiring a store-room for James Martin, architect, and Mr. Martin has another job in which particularly careful work is required, he would much rather be sure of Johnson getting it, by making a percentage agreement, than have to take bids and feel called upon to let the contract to the low man, irrespective of his previous record, and without regard to whether the architect himself had tried him out on other work. That makes the percentage plan easy and convenient for the architect.

Then, too, many an owner has a friend in the business whom he would like to favor. Under the open bidding system he does not feel justified in apparently throwing away money merely to favor a friend. Consequently if somebody else bids lower than the concern he is acquainted with, it is seldom he interposes a request to give the contract to the higher man. With the percentage system, he can do this without feeling that he is making the job cost him more than a fair price. He is sure of getting it at a proper charge, for labor plus material plus profit should be easy to figure.

It must not be thought, however, that the percentage idea solves all problems, and makes life's path easy for the contractor. There are difficulties and irritations involved here as well as under any other system, for no change in methods will change human nature. The contractor who is inclined to beat the owner under a bidding system will probably attempt the same thing under a percentage plan.

In fact, cases have been cited in which the contractor padded his expense bills, charging the owner the list price for material, without showing the discounts received. Time for labor was also increased, helpers being put in at mechanics' prices, and other features of that kind developing. Carelessness in buying and using material when the owner is footing the bills is also apparent in some jobs handled on the percentage plan, and when this occurs the system is given a bad name.

Another difficulty is determining just what the percentage should be. And, after all, here is an opportunity for bidders to be pitted against each other, for the man who agrees to do the work for the smallest percentage over and above the cost of the material and labor, other things being equal, is likely to get the job. So adopting this plan does not entirely solve the problem, by any means.

One large contractor in an Ohio Valley city believes that 20 per cent, plus a proper charge for supervision, is a fair basis on which to handle the business. He points out that he is entitled to a profit both on the material used and on the labor supplied, and that it likewise costs money to have the work properly supervised, supervision not being included in the labor item, as a rule. But sometimes he finds that other contractors are willing to eliminate the supervision charge, and also to shrink the percentage of profit, the incentive to the man who has no very high principles for the conduct of his business being so obvious that a good many of them will take the work for almost nothing in order to have an opportunity to make money by "faking" their bills.

"The percentage plan has been given undeserved unpopularity among certain owners and architects," said the head of the concern referred to above, "because of their experience in dealing with contractors who did not play fair. It might be said that under such a system the owner would be foolish to give his work to anybody except those he knows he can trust completely. But if one man is willing to work for a smaller margin of profit than another, he is likely to be given the work. The contractor of this kind may think that it is legitimate to make up for a narrow margin of profit by padding his bills, and get his profit in some other way; but we believe in laying all our cards on the table and stating

in the beginning just what the charge is going to be, above the cost of labor and material."

A phase of the plan which seems to meet the objection that the contractor has no incentive to work out effective methods of cutting costs and reducing the expense of a job, in view of the entire cost being borne by the owner, is the award of a bonus. The architect figures an estimate, which is agreed upon as representing the probable cost of the job, and the contractor gets 50 per cent of any saving made in the work compared with the original estimate. This makes it worth the while of the contractor to reduce the expense wherever it can legitimately be accomplished, and gives him something to work for. This plan has been used successfully in a good many cases.

The percentage idea is undoubtedly interesting. It has its defects and drawbacks, but appears on the whole to mark an improvement over the typical system.

Engineering Law

By Thos. H. Ray,*
of the New York Bar.

Performance of Contracts.

Waiver of Performance.

In connection with the theory of substantial performance of contracts the question often arises as to whether or not the owner by taking possession of his property does not waive an entire and exact performance of the work by the contractor. The principle advanced by contractors in support of such claims has been the same as that which is set up in the case of sales of personal property. There if a reasonable opportunity is given to the purchaser for an inspection of the property bought so that he either knows or should know of any defect in it and he then retains possession, the law implies an agreement on his part to pay for it. If it were defective he should not have kept it and made use of it. But in the case of building contracts, where the work is done by the contractor upon the real property of another, the owner must necessarily accept the benefits of the contractor's work as the job proceeds and in advance of a complete performance of the contract. Each day as the work progresses something is added to the land of the owner and he has no choice but to accept it and wait until the work is completed to determine whether it is in accordance with the contract.

If after the completion of a building contract, it develops that the contractor has not complied with the specifications, in other words, that he has not substantially performed his contract, it would not be fair to say that because the owner has moved into the property and taken possession, that he had waived his right to insist upon an exact performance by the contractor. The owner in such a case has no choice and cannot do otherwise than wait until the work is completed in order to determine whether or not it has been properly done.

Thus, as one court states:—

"The owned from the nature of the case takes the benefits of part performance and therefore by merely so doing does not necessarily waive anything contained in the contract. To impute to him a voluntary waiver of conditions precedent from the mere use and occupation of the building erected unattended by any other circumstances, is unreasonable and illogical because he is not in a situation to elect whether he will or will not accept the benefit of an imperfect performance."

But this is not to say that the owner can never waive the defects in the performance of construction contracts. Whether or not he does so is a question of intention. If the owner clearly shows an intention to accept the work as completed and to waive all defects the contractor will be released from further obligation.

Thus, in a case where the contract was for the erection of a building and after its completion the owner wrote to the contractor saying that payment would be made to him "as soon as the building was completed according to the contract; the ventilators must be put in," the court decided that the letter amounted to a waiver of any defect other than the absence of the ventilators and that when they were put in the contractor was entitled to payment.

Impossibility of Performance.

Numerous questions have arisen as to how far changing circumstances may alter the obligations of the parties to the contract, and as to their rights when one agrees to perform a certain act which later turns out to be extremely difficult or impossible of performance. The general rule may be stated that where an agreement is made to do a thing which is impossible of performance that the contract is unenforceable. But if the agreement is possible of performance even though it be impossible for the individual who has promised to perform, then the contract will be enforced and the parties held to the bargain which they have made. No excuse of performance will be accepted unless it be shown that the thing cannot by any means be effected.

What is an impossible undertaking for one man may not be impossible for another. What was impossible a century ago may be a daily occurrence today. If in the year 1814 a man contracted to fly from New York to Philadelphia each day for a week, the courts might well have said such an undertaking was impossible of performance. If the same contract were made to-day, while it might be impossible for the individual promisor to complete his agreement, it could by no means be said that the contract is impossible of performance and therefore the contract which a century ago would not have been binding, would to-day be upheld.

These questions most often come up in Engineering and General Contracting work, where unforeseen contingencies arise which make the performance of the contract either extremely difficult or in a sense impossible. It is important, therefore, for the contractors to provide in their contracts against such accidents or occurrences as may unexpectedly arise and cause delay in the work or make performance of the contract impossible, such as strikes, boycotts, inclement weather or other unforeseen difficulties. Where there is no such provision the contractor will be held strictly accountable for the performance of his contract and will be liable for the payment of damages in the event of his failure to do so.

There are, however, exceptions to the general rule and one such is in the case where performance becomes impossible because of the destruction of some thing which in itself is essential to the further performance of the work. Thus, take the case where a contractor agrees to furnish necessary material to do certain work in connection with the erection of a building; after he has partly performed his contract and received several installments of the contract price the building is destroyed by fire without the fault of either party. Generally speaking in such a case the contractor would be excused from further performance because of the contract became impossible. The contractor, however, would be entitled to recover for the work which he had done and for the materials which he had supplied because the labor and material had become the owner's property and thus the fire destroyed the owner's and not the contractor's property.

It is necessary to make a distinction on the other hand between this kind of case and that in which the contractor agrees for a fixed price to supply all necessary material and work and deliver to the owner a completed building. In the latter case the contractor obligates himself to erect and deliver to the owner a complete building and he does not perform his contract until he has done so. If one house is destroyed by fire before its completion and acceptance by the owner, the contractor can build another and under the contract he must do so.

Where such a case arose the court so decided, and said:—

"It is not the providence of the law to relieve persons from the improvidence of their own acts." * * * "When one of two innocent persons must sustain a loss the law casts it upon him who has agreed to sustain it, or rather the law leaves it where the agreement of the parties has put it; the law will not insert for the benefit of one of the parties by construction, an exception which the parties have not either by design or neglect, inserted in their engagement. If a party for a sufficient consideration agrees to erect and complete a building upon a particular spot, and find all the materials and do all the labor, he must erect and complete it because he has agreed to do so."

A further exception has been made by some courts in the case of large undertakings where after the work has been begun it has developed that such conditions as are necessary for the carrying out of the work do not exist. Thus, in a recent case, in the construction of a canal extending over many miles, after contracts had been let for the performance of work in sections it turned out that natural conditions of the soil unexpectedly appeared which rendered performance of the work as originally planned impossible and necessitated a

*Member of the Society.

change in route; the change of one section necessitated corresponding changes on others, so that adjoining sections might meet and form a continuous canal. The courts held that the law would imply a condition as part of the contract, to the effect that the meeting with such unexpected circumstances was sufficient to permit the State to terminate the contract. Both parties were excused from further performance and the contractor was permitted to recover for the work which he had already done, but was not entitled to recover the loss of his prospective profits on the entire job.

The court in speaking of this implied condition to be found in such contracts used the following language:—

"These terms are implied in the contract by force of the law itself, and not because the parties had them in mind."

"In the eyes of the law being a part of the terms of the contract, the conditions that render performance impossible do not terminate the contract ab initio, and vitiate what has been done and what remains to be done that is capable of execution. The conditions may be of such an extent as to amount to a substantial abrogation of the entire contract, or they may relate to an insignificant part of the contract, but they excuse performance only to the extent to which performance is impossible, and leave what has been done valid, permitting a recovery therefor, and may not excuse performance of the remaining work. No general rule can be laid down which will apply to all cases, but each case must be decided upon its own facts."

Accounting Department

Conducted by Harry M. Smith,* Certified Public Accountant.

The subject of cost keeping for contractors appears to be a popular one with a large number of the contributors to the various publications devoted more or less to the contracting industry. Obviously it is an important matter, but like many other important matters, it apparently does not receive the serious attention it deserves. At least, that is the impression conveyed by many of the writers whose articles have been reproduced for the benefit of our members. Such writers, no doubt, are in a position to clearly present the conditions as they exist and it is probable that practically all of them are actively connected with some form of contracting work.

There is a story told of a clergyman, who when called to fill a pulpit temporarily, surprised the congregation by preaching the same sermon on several successive Sundays. When questioned by certain influential members of the parish who desired to ascertain the reason for his extraordinary behavior, he surprised them to a still greater extent by declaring that he would preach no new sermon until he was satisfied that they were following the advice he gave them so liberally in his past sermon.

Therefore, emulating the example of the clergyman, it is desired to continue present articles that should prove of value to certain contractors in our membership.

Mr. Charles L. Pitts is the author of the following article which appeared in The Contract Record under the caption: "Cost Keeping for the Small Contractor." It is reproduced hereunder in full:

The most important item in the office work of any company, great or small, is to have an accurate and accessible system of costs: to be able, in a word, to tell exactly just how much it costs to manufacture a certain article or to undertake a designated work.

To the average small contractor, "cost" simply means the actual payment of cash for anything he may happen to buy. He neglects the fact that it is just as important for him to know, to a cent, what it costs to run his business as it is for the great construction company, with an international reputation to sustain, to know the exact cost of some gigantic undertaking. On costs depends the foundation of the contracting business.

To the small contractor the chief difficulty is in the general distribution of his work. In the absence of gang clerks, and, in common with most small contractors, acting as his own general foreman, he is too busy to handle any complicated system of cost-keeping; therefore, he must use some system which is not too exhaustive but accurate within a reasonable degree.

*Asso. Member of the Society.

WEATHER:

DAILY WORK AND COST CARD

Foreman:
Location of Work: Gang No.

Material Received	Quantity	From	Cost per Unit
Brick:			
Lime:			
Gravel:			
Cement:			
Lumber:			

Material Moved	Quantity	To	Time & No. Men

Material Left Over:

Delays: Cause Cost:

Completed Work:

Brick Laid:
Sq. ft. Concrete:
Excavation, Yds.
(How disposed of)

Remarks.

Total Cost of the Day:

Daily Card to be filled in by Foreman with the exception of the costs.

The most satisfactory method for the contractor with two or three gangs of men working in different parts of the town is to use the Daily Card System. This calls for the assistance of each Gang Foreman in the filing out of these cards. These cards are a daily record of the material received; number and time of men; material moved; delays for any reason; time of hired teams; time of owner's teams; weather conditions; amount of each different kind of work completed; material left over after the completion of that work, together with a column for remarks. These cards will vary with the general conditions, of course. To augment these cards there are the Order Books. It is well to remember that a foreman, in the hurry of the work, is apt to be inerror with the order books, as has often been proved; therefore these books should not always be regarded as final in the event of a dispute, though, if a check be given to each teamster for each load, such mistakes will not be frequent.

The cards are filed under the heading of the street on which the gang was working and the order-book stubs are retained until the accounts have been paid. At the end of each month the cards are entered upon what is known as a Recapitulation Sheet. This is a monthly report in a brief form and shows which of the gangs has done the most work for that month, as well as the total cost of the work and the number of rainy days in each month. In brief, it is a monthly record of business.

The work of the small contractor may be divided roughly into four classes; first, material; second, labor; third, delays, and fourth, overhead expense.

Material received means more than, for instance, simply dumping a load of gravel and the final payment for same. It means the actual number of loads received on a certain date, where they were delivered, if any was left over, and, if so, where the surplus material has been removed to and the time it took to make that removal. If there are five loads of any material to be removed from one job to another, that is a charge against the work from which it was removed, because surplus material should not be brought upon the work.

Labor is the next consideration. If a gang of men are idle, or nearly so, for any length of time as a result of the non-delivery of material, or for any other cause, which, while not actually stopping the work, sends the men to some time-filling job to keep them on the work, then this is a charge against that work. If a gang of men doing any repair work or any work not tending towards the completion of the job, then this also is a charge against the work. Also, any work, such as cleaning up, or repairing machinery, is a charge—in fact, any work around the job not an overhead expense is a charge against that particular work. The only satisfactory way of keeping wages is to charge each man's time and rate as a separate account: not, for instance, "ten men, three hours," but one man, at so much, so many hours, and so on.

Delays are, of course, a charge against the particular work where such delay has been, unless the delay has been caused

No. Date	No. Date
Received from:	Received from:
Article:	Aticle:
For work at:	For work at:

Foreman's order book. To give slip on receipt of goods.

partly by a piece of broken machinery, etc., then the cost of such work is charged to overhead expense, because it is too complicated, in a simple cost system, to charge machinery breaks to any particular account, as the machinery is used in all the work the contractor may have. Delay charges are, naturally, a part of the labor costs, inasmuch as they are usually caused by labor. It is well to know, though, in reckoning up a loss, just what has caused that loss—material, labor or delay

Overhead expense is any expense for the general up-keep of the business so distributed as to be impossible to charge to any particular branch Office expenses, for

CAR RECORD (Sample for book to be ruled).

No.	Initial	Ordered	From	Placed	Test	Unloaded	Used at

Sample of Car Record Sheet for keeping track on cars. This sheet when filled in, is a useful addition to such advice as the contractor receives from shipper.

example, are in this class; but tools, etc., though for the general use of the business, are not. This is a charge for the particular job they were bought for. Tools are sometimes lost or stolen and therefore the only way to keep track of this account is to charge it to the job. An Overhead Expense account is not deducted from the profit until a balance is taken at stated times.

An accurate cost system is one in which

MONTHLY OFFICE SHEET No. of idle days

No. Gang	Location Work	Time on Work	Cost Material	Labor Cost	Tools Cost	Total Cost of Job		Remarks

Total costs for all work completed, and total cost of all business for the month, including Overhead Expense.

Sample of Monthly Office Report. Profits are not usually placed on a sheet of this kind but are kept in the regular books.

the contractor can look back through his cards and price book—it is not always advisable to let the foremen know the exact cost of the material—and see just how much his material cost; the cost of the labor; the cost of the tools; the time of delays; the cost of repairs; the cost of extra work and where the charge for this work is to be placed; how much of his own time he has charged against each job; the cost by the foot, or by whatever measurement he uses in his business, and many other items in proportion to the perfection of his system and the care he uses. A cost system to be of use must tell the user how it is done and tell him in the shortest possible time.

In the exacting systems of the large contracting firms, there are car sheets, material records, time sheets, tool sheets, order forms, receiving blanks and a hundred-and-one reports. They get their costs to within a cent, but they pay large salaries for that knowledge. Such is not the system for the small contractor, because it is too expensive; but even the small contractor should know, within a dollar or so on the hundred, where he stands. He should know when a car is placed, when he ordered it, when it is unloaded, the number of the car, the cargo, and where he used the contents of that car. He does not want a car sheet for that; a ten cent book will do if properly ruled. At the end of each day he should have a fair idea of his profit or loss for that day. If he has lost he should know why; and if he knows why, possible he can think of some way to avoid similar loss the next day.

Cost-keeping is not designed to do away with book-keeping. Its function, as its name implies, is to "keep the cost."

With an accurate cost system the contractor has his business in perfect control. Without it, the business controls him.

Employment Bureau

Men Available

Actuated by a desire to be of direct assistance to all its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on the file at the headquarters of the Society The list of men available is made up wholly of members of the Society, and as such is entirely dependable In communicating kindly address Employment Bureau.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

006 Superintendent with twenty years' experience in heavy construction operations, competent to handle large jobs successfully. Good organizer, now open for engagement. Considered a hustler. Any location. Age 43. Practical experience in installation and operation of cableways, shovel, pile-driving and such apparatus. Member of the Society.

007 A neat little organization with $2,000 to invest, consisting of a competent ESTIMATOR, with four years' successful record (Member of the Society) and a superintendent mason, and a carpenter with four years' success in handling concrete work, desire association with an experienced contractor with sufficient financial resources. Write to the Secretary for further particulars.

008 Charter Member of the Society. Employment desired with a railroad company on maintenance of way, revision or appraisal work, or position with a construction company. RECORD: Civil Engineer. Twelve years' railroad work as transitman. Engineer. Roadmaster. Engineer of Maintenance Way. Last five years and at present a member of a construction company engaged in heavy foundation and reinforced concrete construction.

009 Member of the Society. Student graduating as Civil Engineer in June, desires position with construction company. Would prefer work in charge of concrete gangs. Has had two summers' practical experience in concrete work as follows: Bent and placed reinforcing rods, run a concrete mixer, charge of concrete gang. Handled the instrument, laying out buildings, giving lines and grades and figured quantities of materials required.

PROFESSIONAL CARDS

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The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, AUGUST, 1914 Number 8

BETTER METHODS OF ESTIMATING.

A FEW days ago a contractor who is a keen observer of the conditions prevailing in contract work, stated to the writer that more contractors lose money because they estimate quantities badly and inaccurately, than for the usually assumed reason that they do not know the actual cost of doing their work. We believe he is quite right.

¶ Much time has been given to the study of cost-keeping and cost-accounting, and advisedly so, for these are important subjects, but why is there no concerted action on the part of Architects, Engineers and Contractors to secure better methods of estimating? Certainly, if it is important to know accurately the costs of the various items that enter into a contract, how much vital is the assurance that the quantities be known with the greatest possible accuracy.

¶ An increase of say ten per cent. in the estimated cost of a certain item might not prove serious if the actual amount of such an item is the same as the estimated quantity, but how much more serious such a mistake would be if the actual quantity is much in excess of the estimate. In a unit contract the percentage of loss would, of course, remain the same, but the total loss to the contractor would increase exactly in proportion to the amount of that item. In a lump sum contract, however, the percentage of loss would be over twenty per cent. when a mistake of ten per cent. is made on both the estimated cost and the estimated quantity, and more or less, according to the original mistake. In either case the extra loss is unnecessary.

¶ As stated by Mr. G. Alexander Wright, the logical and correct transaction between owner and contractor is based on a certain quantity of work for a certain sum of money, the owner to determine the former and the contractor to fix the latter. Surely this is morally just and fair.

¶ In a report to the American Institute of Architects, Mr. Sullivan W. Jones said: "Competitive bidding is fast degenerating into a disgraceful scramble from which the contractor who will take the longest chances generally emerges as the successful bidder. These conditions are undermining the contractor's moral stamina and are fostering and encouraging business brigandry in the field of building instead of honesty and efficiency."

¶ This is not putting it any too strong. The present scheme is simply irrational, silly, wasteful and wicked.

¶ To begin with, the Architect or the Engineer must, or should, make a complete schedule of quantities in order that he may know what his proposed structure will cost, unless he is going to guess at it, which is done more often than not.

¶ Then each bidder must in turn prepare a list of sizes, amounts, etc., and carefully compute the cost of each item, unless he, likewise, is going to guess, and most of the time that's what he does because he usually has not the time to do otherwise.

¶ Here then are a group of men who go on doing the same thing over and over again while it should be done only once for all. A little thought will show what an economic loss that means. Yet it is going on and has been going on in this country for over a century.

¶ Lately, trade papers of all kinds and grades have given much space to the advocacy of the so called "Quantity System." But it will not do to merely talk about it. To many, the importance and advantage of the system are not apparent because the methods recommended are not understood. In order to take up this subject in a practical way, and to educate the Owner as well as the Engineer, the American Society of Enginering Contractors has organized a new Committee whose Chairman is an experienced Quantity Surveyor and who will be assisted by contractors and by engineers whose knowledge is based on actual practice, together with two attorneys practicing Engineering Law, the latter being very valuable on such a Committee because of their training in the legal aspect of Engineering matters.

¶ A preliminary report of the original Committee was printed in our last issue and contains much of value in this connection. The object of the enlarged Committee will be especially to devise uniform standards and rules for the measurements of materials incorporated in a structure. Eventually, it is hoped that an organization of experts in each trade may be formed in this Society, qualified to act as official Quantity Surveyors. Only by thus making a practical beginning can we hope to see our ideal realized.

¶ The views of our readers on this topic will be given careful consideration and all are invited to join in the discussion which is the object of this article.

Engineering Vernacular†

By John C. Wait*

I HAVE been deeply impressed of late by an apparent deficiency in the use of technical terms, and particularly among engineers. In my own family, in my office and in business the want of words among young men has been painfully apparent, and I have inquired and sought to ascertain the reason for it. I think I have discovered two material causes:

(1) A desire to entertain or amuse by the use of up-to-date slang, or local and class terms; and

(2) A gross indifference among young and old to acquire or use correct terms.

To illustrate:—An automobilist would instruct his son to keep a strict watch upon his work by telling him *to keep his lamps on it;* an aviator would instruct a reeling fellow the worse for drink *to warp his planes or wings.*

Other trades or specialists would use similar figures of speech readily understood by their associates, but quite meaningless to the ordinary layman.

The first Engineering Vernacular that the speaker recalls was in 1879, from "Charlie."—excuse me,—Professor Crandall. We had a meridian instrument set up and were observing the transit of—Venus, presumably, for Charlie was younger then,—when I clumsily bumped one of the pods,—legs,—of the transit, I mean,—Charlie was observing the transient face of Venus, and I was not observing my proximity to the transit's legs. Charles made an observation on Venus, and then made one observation on me,—in very brief vernacular. He said, "Hell! Wait, what are you doing?"

Well! for Charlie Crandall, you know, that meant a good deal of vernacular. He had lost his observation, but he wasn't looking on the ground for it,—he was looking for the cause. This exclamation was vernacular which was frequently quoted to the speaker for three years after.

Professor Fuertes had a vernacular for this very situation, but it was usually before the accident that he applied it. He would say, "I have a very bad corn on this toe, and an ingrowing nail on another, and I have a bunion on this other foot. Please, gentlemen, have consideration for me." The boys followed this advice about as well as they did his instruction in levelling up a transit or level, which was, "Never put any more force into your fingers on those levelling screws than the weight of a one-cent postage stamp."

Up at the Harvard Club the other evening I heard some Engineering Vernacular. The members of the Cornell Engineers' Society were the guests of the Harvard Engineers' Society. A Cornell man and a Harvard man were discussing mechanics, and the former was telling what a wonderful man we had at Cornell and what a book he had published on the subject. Incidentally, he mentioned how much merriment the boys got out of the speech by this same remarkable man on Mis-Applied Mechanics. The Harvard man wanted to know if we really did have ladies equal to this Miss Applied Mechanics. "Oh, yes," the Cornell man assured him that Cornell had several misses, among them Misanthropics, Misdemeanor, Miscalculate and lately a Numismatics had arrived, a sister of Mathe (w) matics and Kin(n)e(y) matics, from Missouri.

* Member of the Society.

† From a paper delivered at the Annual Banquet of Civil Engineers of Cornell University.

Contractors have often been accused of improper use of the English language. However, they are not the only ones, as can be readily seen by picking up and reading any specification for work upon which they are asked to bid.

Mr. Wait in his entertaining and humorous way, criticises the misuse of our language, with special reference to its misapplication and abuse in the engineering and contracting field.

Speaking of this big little man reminds me of an incident on our Annual Geodetic Survey. The classes of '79-'85 were the boys upon which the professor tried his book, and during the years 1880-1 we had problems in rowing, baseball, shot and hammer-throwing tried out on us in the mechanics classes as original problems. Trumbull, '82, and I had done some trapeze work in the "Gym," and not having much to do(?) on the annual survey, except between daylight and dark, we took a trapeze bar and erected it in a tall tree near the hotel, to get a little exercise. One evening, while hanging from the lower bar by my knees and tossing "Billy" from hands to feet and feet to hands, he and I simultaneously discovered Professor Church on the balcony of the hotel, making notes on our performance. We were both so startled that I nearly dropped "Billy," owing to his becoming stiff with anxiety. We got back into a sitting posture as quickly as possible, and "Billy" said, "Did you see that apparition, Jack?" and I said, "You mean Mechanics?" "Yes. God help the boys who figure out that stunt. Church will want them to give the strain in every muscle, at every joint, in the bar and on the ropes, besides the curve of rotation when I turned from end to end. Gosh, but I wish it were as easy to work that out as it is to do the stunt."

During the construction of your Auditorium Building I came upon a workman digging a trench. I said, "Hello, Mike, what are you going to do?" he said, "I am going to dig up a dead man." I went along a little further and found another man digging a trench, and said, "What's the hole for, Tony?" and he said, "To bury a sleeper." I said, "What! has the cemetery been extended up here?" I went into your new building and said to the carpenter, "What will you use for jambs, Frank?" and he said, "Ash." A workman came along and asked him, "How do want that block cut?" and the foreman answered, "The bed and joint 6-cut, and the face 12-cut."

It is my impression that the vernacular of the early day was more of an application of the subject matter, of class-room or professional terms to student life and intercourse, than it is to-day. I know the mechanical engineers used to tell us when we had indigestion that our injectors were off, and when winded that we would have to put on the blower, and that when we got hot to turn off the blower. The civil engineers would advise the mechanical engineers to shift their eccentrics and lengthen their cut-off and work more on live steam; that they were off their center of gravity, *i. e.*, were eccentric. Chum used to tell me that I was reaching my ultimate strength or exceeding my modulus of elasticity, or that my moment of inertia was low.

The inventive talent of engineers and the monopoly which the engineering profession has asserted over practically all other professions are exhibited in the vernacular applied to the different departments of engineering. In the '80's engineering comprised the original military engineering, civil, mechanical and mining engineering. Later there were created electrical, sanitary and hydraulic engineering, and about the same time railroad and highway engineering; still later, the profession was divided into designing, construction and consulting engineering, and to these were later added municipal, public service, chemical, and heating, ventilating and refrigerating; then came dynamic and pneumatic engineering. It has been expanded so as to cover bookkeeping and economic investigations into so-called efficiency, utility, administrative and executive engineering; then the utilizing of waste products has created conservation and disposal engineering; then, invading the field of the promoter, we have promotion and development engineering. The new and youthful administration of the City of New York has recently developed and installed bureaus of research and emergency-engineering, and the Bridge Department of the City of New York, which was one of our largest departments and which has built many noble structures, but which for some years back has had little bridge building to do, in order to maintain the corps has created offices of advisory and administrative engineering. To these there may be added the recent title established in the Highway Department of the State of New York, according to reports of the investigation committee, of "Transfer" engineering, for those who have required contractors to live up to their specifications.

It is expected that within a few years the engineering profession will cover practically all other professions,—clergymen will become glory engineers, doctors misery engineers, and lawyers trouble engineers, and carpenters, blacksmiths, masons, etc., will be known as wood, metal and stone engineers.

An illustration of Engineering Vernacular is to be had in the following:—An erecting contractor, who was building part of one of the great suspension bridges across the East River in New York, visited my law office and undertook to explain his troubles to one of the young lawyers. The would-be lawyer made notes and, confessing that he did not thoroughly understand the situation, made a report in substance as follows:

"A Traveler was on the lower cord of the approach span of the Williamsburgh Bridge and was sustained by four Guys. Each Guy was held fast by two dogs, after passing through an opening in the tail piece. Tony, an Italian, had just been sent out and had given two of the dogs a fresh bite on the longest Guy, when they let loose, one of the Guys slipped, and the Traveler tipped over and threw the counter-weights into the air, and they went down on the street below and killed a man."

The contractor wanted to know if he was liable, and the young lawyer was quite unable to tell him.

An illustration is found in the following report by an engineer, which sounds more like a physician's or nurse's confidential report on some royal nursery. It says:

"The basset is only a blossom, and not promising. There are twin brats not worth a breast, yellow with fool's gold and almost without bone. A few strokes with the bede or bulley would show they were no good. One of them has creeps and will have to be cribbed and cross-headed. One of the brats' bottoms was damp and will have to be drained and ventilated, and it has devil's dice.

"They have in the plant dollies, gads, gibs, fans and hurdy-gurdies; also dogs, donkeys, jacks, puppets and monkeys.

"The whole combination is not worth developing, and I recommend that they be Oslerized."

A mason contractor once came to my office during my absence, and one of the young lawyers undertook to transmit a message of his trouble.

He reported that he had been employed to remodel a masonry dam, and he said a Flemish bond was first required of him, but that the engineer wanted a better bond and insisted on having greater security. The engineer insisted that the stretchers should be bonded by an overlap of the bed by not less than 15 inches, and that every alternate course of the dam should be tied with a header. He also required the length of each stretcher to be three times the rise, and the depth of the header in the backing equal to three times the rise; that the rock face of the remodelled dam should be draft-lined, the molded face should be 6-cut, the base pean hammered and the water-table the run of the quarry; the arch rings were to be bush-hammered close-jointed and grouted, all to be battered and broken ashlar; that the overflow should be in 12-inch risers and treads, and the steps rough-cut, all interior spaces to be thoroughly grouted with neat cement.

It is needless to say that the young lawyer had little idea of what the contractor was talking about, and as he had spelled dam "dame" and had mistaken the subject matter, he was thoroughly confused.

Get away from the idea that the cultivation of speech is a mere artistic accomplishment. It is a necessity. Anything that may save or may prove a loss of thousands of dollars is a necessity to an engineer.

I will ilustrate by three instances that have come to my notice in my experience.

An engineer undertook to write a specification for 1:2:5 concrete. He described it as follows:—Take 1 part cement and 2 parts sand, and thoroughly mix dry; then with one part of this mixture mix 5 parts of stone, and wet to a proper consistency for concrete." The specification was for concrete sub-base for paving city streets. It cost the city thousands of dollars to correct it. Was the mixture 1:2:5 or 1:2:10 or 1:2:15, or what was it?

Another instance was on the Bronx Valley Sewer, a $2,000,000 contract. The engineer described the contract as a 1:2:4 mixture; then to be technical he specified that a batch of concrete should consist of one barrel of cement (original package of 3.85 cu. ft.), two barrels of sand loose (the equivalent of 3:25 cu. ft. each), and four barrels of stone, thoroughly mixed. What was the real ratio?

The contractor was required by the engineer to mix the concrete in the raito of 1:1.69:3.38, and he has brought action for $36,000 on account of excess cement required.

Another instance which has recently cost the City of New York over $40,000 is as follows:—The specifications provided, under the heading *Masonry*.

"All masonry shall overlap the joint underlying course by at least 15 inches"; and under the heading *Face Stones*.

"Every second or third stone in the face shall be a header, and every header shall be in length three times, and in width two times, the rise; all stretchers shall be at least three feet in width."

The City's engineers required the face stones to overlap the backing by 15 inches, and the court required the City to pay for the excess granite. The recovery with interest amounts to about $43,500.

The use of plain English is an art. An art, gentlemen, and a subject that deserves your best attention. If you will enter into an ordinary agreement of employment or a co-partnership, you need the masterly use of technical English. If you will address yourself to an employer, a promoter, to a town, county or state official, or to a financier, you must have the power of speech.

The student engineer has splendid opportunity to cultivate a speaking voice. Surveying, land and hydrographic, cultivates a strong voice. In the mill or shop, conversation must be carried on under circumstances similar to a public hall. He does not need to go down to the seashore and talk with pebbles in his mouth to the restless waves, as did Demosthenes,—he can talk his tongue loose at some rodman or stadiaman, or exercise his vernacular in his solitude on the roof of a barn, signalling with the heliograph to a distant station, whose attendant is flirting with a village maiden.

"Conversation is the laboratory and workshop of the student."—Emerson.

"Conversation is the image of the mind; as the man, so is his language."—Syms.

How many of you young men truly believe it? How many of you would wish to be judged, measured or weighed by your speech? Yet I can assure you that Emerson knew human nature as few students ever knew it.

Why! if some of the students were to be valued by their speech or conversation, they would not be worth their keep, for some of them do not converse twenty minutes per day either with themselves or others, and what they say does not make any impression and might as well not have been said. Most of what is said has been said by a hundred others the same day. Probably half of it is nothing but parrot-like expressions used on the stage or at the cabaret, new and catchy expressions, meaningless except to the man about-town, the baseball *fan* or football *rooter*,—two instances in themselves. There is no study or effort to acquire or use good, wholesome English, or to acquire a vocabulary of professional engineering terms. Sport and stage vernacular are most common and every young man an adept in the art, but how few know the most ordinary engineering and trade names. What a soffit, a stile, a jamb, a putlin or trim, in a building operation? What is a traveler, a hoist, a strut, a girt, a gusset, a center or a header, in ordinary construction work? Few of you can tell. Yet why is this?

When you graduate and take a position you cannot write a report, make a requisition, give instructions or direct mechanics, or take and even transmit, much less execute, orders using techincal names of plant, tools and machinery with which you accomplish engineering operations.

The foremen, superintendents, stenographers or clerks of the purchasing agent better understand, the engineer's vernacular.

What greater gift has man than speech? How many centuries has it taken to perfect it? By what tedious evolution has our language reached the flexible, adaptable and precise condition that now exists? What labor have Chaucer, Johnson, Bacon, Pope, and Tennyson performed to mould it to its present state? Is there any greater misfortune that could overcome the human face than the loss of speech or the loss of a single element of it? What man would be so imprudent as to wilfully destroy its purity and beauty?

Yet what young man gives voice to common, useless slang but is toying with this most priceless gift?

One would expect that an engineer who appreciates the precision required in his mathematical operations, the obedience which nature demands by her laws, the economy practised in design and the painstaking care with which mechanisms must be fitted or adapted, would reflect in his speech those same qualities.

Every engineer knows the extreme necessity of maintaining the purity of the air we breathe, the water we drink and the foods of which we partake, but how few engineers apply those principles of sanitation to their language, either written or spoken.

What does it matter? you may ask. It matters far more than young men appreciate. There is no better introduction to business men than clear, correct and easy speech and the proper and fluent use of appropriate words,—there is no surer means of persuasion.

But how can I study language, literature and elocution, with all the studies that are required of me now? you ask. You do not need to. The child does not attend school, yet the average infant between three and four years old acquires more good English than many college students do in their four years' course. Why? Because the child endeavors to learn, acquire and select appropriate words, which the student does not. Any young man may acquire golden speech if he will but try, in his ordinary, every-moment conversation, to select appropriate words and to connect them according to the most elementary principles of grammar Do you want illustrations? I wil give you some.

In 1878 there entered at Cornell a young man who afforded much amusement to his classmates. In recitations he was slow, deliberate and quite laborious in answering questions and in reciting; so much so that he was ridiculed and annoyed by laughter and comments *sub voce* by his fellow students. However, he persisted, and *he was the ivy orator* of his class.

Another instance:—Some years ago an ordinary mechanic was at work in a railroad shop, tending his lathe. One thing he had which distinguished him from his co-laborers,—it was deliberate, careful speech. Having that qualification, he presumed one evening at the Railroad Club to make a few rémarks, and this was followed from time to time by further public utterances. Five years after, he emerged from the shop to the position of master mechanic, and a few years later was superintendent of motive power of one of the large railroads of this state, and about that time he was also made President of the New York Railroad Club. This promotion and rise were attributed solely to his cultivation of the English language.

What is the heedless indifference that most engineers have for speech? What is this freedom that gives license to slang and useless words? Why call a man who is dull a "bonehead," "cement dome," or "solid ivory"? Why are sugar, salt, butter, doughnuts, bread and coffee called "sand," "thirst," "salve," "sinkers," "punk," and "boot-leg"? Why disgust the finer sensibilities of your mother or sister by referring to your eating place as a "rendezvous of dogs?" You certainly would be grievously offended if an Italian, after accepting your hospitality, spoke of your eating place as a "dog." Then why such license? It is not in keeping with the care, selection, precision, economy and consideration that attend your every other engineering operation

I appeal to you to safeguard your speech. Cultivate technical words of your profession and of the trades which you must employ and direct. Study requisitions and sepcifications.

Business Methods on Construction

THERE has been a great change in the ors due to a change in conditions unmethods used by successful contractder which the work is now done. Successful contractors no longer "guess" the quantities, but study each contract and obtain complete data relative to it before submitting their bids. The following article has been abstracted from a discussion of this subject by James L. Stuart, Contracting Engineer, Pittsburgh, Pa., in the September issue of the *Journal of the Cleveland Engineering Society*. In our abstract we have taken material from both the original article and from the discussions brought out when the paper was read.

Perhaps there is no business which responds more quickly to what is termed "business methods" than does the average piece of construction work. Certainly there is no business with more diversified interests and trades connected with it than the modern structure, be it railroad terminal, factory office building, hospital, or hotel.

It has not been more than 20 years, at most, since the construction of buildings was left entirely to practical men who had themselves worked up from positions as artisans or laborers to positions of leadership in constructional lines. Some of these leaders in the past were most talented and even brilliant, but they did not bring with them into the business, except in rare instances, the methods of the trained engineer or the progressive business man, their principal assets being nervous force, executive ability and practical knowledge of the building trades. However, as building construction became more complex and of greater magnitude, the necessity of trained men who understood the engineering problems and who appreciated the application of business methods necessary to bring "order out of chaos" became more apparent, and now both engineering knowledge and modern business methods are most necessary to get proper results as to economy and quality in all of the larger undertakings.

Methods and Organization.

In order to successfully construct a building, it is necessary that one should anticipate each step in the progress of its developments and outline a complete system for its erection, including the various steps from the time the drawings are received from the engineer or architect until the building is turned over completed to its owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery, and numerous smaller items. These estimates of cost were originally made up by the contractors themselves and were but approximations as compared with the present method of compiling them. In the latter method every advantage is taken of the prevailing market prices when the estimate is made, of the conditions of the labor market, the physical condition under which the work is to be done, and the season of the year. In a properly prepared estimate the unit prices should vary on each individual piece of work, whether figured at the same time or not.

After the estimate has been made of the total cost of the building—and I think an estimate should be made of every building whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule is based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project, and a familiarity with the estimate which, as I have said before, gives the quantities of the different kinds of material and assists in estimating the length of time required to complete the various stages of the work.

After the estimate and the time schedule are completed and the contracts for material and labor have been entered into, the *real work begins*.

A dozen or more sets of drawings are procured from the architect or engineer, a copy of same placed on file in the main office of the builder, one copy sent to the job office and the others distributed among various sub-contractors who have to make up their shop drawings and prepare certain materials to be later installed in the building. A careful record must be kept of these drawings and to whom they are addressed and the date on which they are sent. While the various departments of the main office keep thoroughly in touch with the work in the field, and the material in preparation, at this point, if the work is of sufficient magnitude, it is turned over to one particular member of the contractor's force, preferably a trained engineer, whose duty it is to keep in thorough and constant touch with all the drawings and all of the correspondence. He also has access to the files of the sub-contractors, contracts, contracts for materials, the original estimate and all other information pertaining to that particular piece of work. It is then his duty to follow up their shop drawings, the submitting of the same to the architect for approval, the ordering of materials by the sub-contractors, and the progress being made through the fabricating shops and mills. This following-up process is part of his daily routine and from time to time reports are made to the superintendent in charge of the actual field work to enable him to know when the material is to be received, when the sub-contractors will have their men and material on the job, all of which enables him to shape up the field work so that certain portions of the building will be ready for certain sub-contractors at a fixed time. It is also his duty to keep track of the change orders and the changes made in the construction of the building, whether it be an addition or a subtraction. You can readily understand how necessary it is that all sub-contractors should be advised of changes, for often when they are conceived in the mind of the owner, their interference will be more far-reaching than he or anyone else anticipated.

A proper executive organization to do the field work is most important. It is far better to have too much assistance in the field than too little. First, there must be a superintendent who possesses rare abilities as an executive, who understands drawings and specifications thoroughly, who has had wide experience in building work and who has a knowledge of the different trades so as to be able to anticipate far in advance of his requirements. Above all, he should be able to create in those working under him, including the workmen employed by his department, and foremen and workmen of the different sub-contractors, an enthusiasm in their work, a desire to see it grow steadily, and to do it in the most substantial manner possible. If the work is of sufficient magnitude he should have an assistant superintendent, or possibly two or three of them, a large enough clerical force to do the timekeeping, and to keep an accurate cost record, and he should segregate the cost of the additional work which was not originally provided for. All of this work, if permitted to lag for even a day, becomes most complicated, and if not accurate, its value is entirely destroyed. In addition to this it is the duty of one of the clerks to send to the main office each day an accurate and concise report on what has been done during the day, the state of the weather, temperature, etc. As the building nears completion, work in the main office lessens, and it is usually an excellent idea to have the man in charge of the particular job in the main office to get in actual touch with the building and to assist the superintendent in picking up the loose ends and in getting each trade completed as rapidly as the progress of the building will permit. The man from the main office) is thoroughly familiar with each trade, knows just what changes have been made in the work, has a splendid knowledge as to how long it will take each trade to complete its work, knows the difficulties under which each has been laboring and can finish his "following-up process" from the field more intelligently than if he were to remain at the main office.

Cost.

The cost of a piece of work is always of interest. The estimating department has access to the daily and weekly cost reports which are compiled in the accounting department, and from these they can compare and report to the proper person whether or not the work is being done each day or each week within the amount allowed for the same in the original estimate. If the work is not being done within this cost, and if the unit prices vary considerably from day to day, an investigation is at once made at the building to ascertain the reason for such fluctuations, to advise the superintendent of the discrepancy, and to see if ways and means cannot be found to bring the cost within its proper allowance—the estimate having been based on the cost of similar work under the same conditions, the proper average should not vary greatly from the amount allowed in the estimate.

The two following examples serve to illustrate the methods which were used in connection with the erection of a large manufacturing plant and a modern hotel building:

Constructing of Large Manufacturing Plant Near Pittsburg.

Some time during the latter part of May, 1910, the manufacturing plant just referred to, covering approximately 15 acres, was almost totally destroyed by fire. All of the buildings were brick, some with wooden trusses and slate roofs, but the greater number were constructed with steel frames and cement tile roofs. The fire in and around these steel structures was so intense, however, that most of them collapsed of their own weight, and were only a mass of twisted steel, broken cement tile, brick and mortar, all of which it became necessary to remove in order to reconstruct the plant. We first received orders to clear the site, and subsequently were instructed to proceed with the reconstruction of the buildings. Fortunately, the power plant had not been greatly damaged, and, as a large portion of the plant had to be electrically driven, we were able to get sufficient current of high voltage to use in cutting up, or, I should say, burning apart the collapsed steel frame, all of which was so badly damaged that it was loaded on cars and sold as junk.

After the site was cleared we began excavating for the new foundations, starting on the buildings which would be required first and those in which the greatest amount of machinery was to be installed. This scheme was followed so as to enable the entire plant to be completed at about the same time. It was the desire of the manufacturing company to commence manufacturing about the first of October, or earlier if possible. The key to this particular situation was to get the steel, of which there was about 4,800 tons. After consultation with the operating and executive departments of the manufacturing company, the order in which the different buildings were to be completed was decided on and the dates were fixed for the delivery of the steel for each building and were included in the schedule for the completed buildings. The structures were quite simple, similar to most of the modern factory buildings, but in order to live up to our schedule we knew we must keep continually in touch with the bridge company and see that nothing was permitted to lag or be left undone in order to make the deliveries as they promised. Our "expediter" was put in charge of the job at once and during the first month spent most of his time between the order department of the bridge company and the steel mills where the plain material was being rolled. After the last of the orders for the plain material had been sent to the rolling mills he devoted his time more particularly to the drawing room of the bridge company and reported daily just what progress was being made in designing, detailing and checking, the number of draftsmen employed, and the progress made on each building. At times it was found that the checking department was overbalanced by the detailing department and that the designing department was not turning out sufficient work to keep the detailers and the checkers busy. This was adjusted by numerous meetings between the bridge company, the executive department, the manufacturing company, and ourselves. I might say, at this point, that the principal requisites of an expediter are, a thorough knowledge of the work to be performed, a pleasant personality, and the ability to interest the people who are actually doing the work—in this case the men who made out the mill orders, the draftsmen, the different foremen in charge of the rolling mill, and the foremen in the fabricating shop. All should be made to feel that their interests are parellel and that what is good for one is good for all. As soon as the drawings for one of the buildings were completed, we saw that this work was put in the shop at once, where someone had already attended to the delivery of the plain material, and that no time was lost in fabricating and shipping the same.

At times during the preparation of the drawings it was found necessary to urge the bridge company to employ additional men in all departments. This required considerable tact and force as, naturally, the heads of the different departments do not care to have their routine changed, or, as they express it, "meddled with." This phase of the difficulty can be overcome only when it is possible to arouse sufficient interest in that particular piece of work. When the work was started our expediter received from the rolling mills, from which he knew the steel was to be furnished, a list of their daily rollings, and we saw to it that certain materials were gotten in on dates at which the first rolling of that particular material was made. This saved considerable time, and we were able to get all of the plain material delivered before the shop drawings were entirely completed on the first building. The meetings between the heads of our department and the heads of the bridge company were most useful. Our expediter was usually on hand, and we were able to discuss the progress made since the last meeting, the condition of the work in the drafting room and in the shop, and to devise ways and means for overcoming any obstacles which had arisen, due either to lack of men or to want of materials.

The steel was erected as fast as the work was gotten out of the mill, fabricated, and delivered. We insisted on its being fabricated in sequence so that any materials delivered at the building could be immediately put in place. It had been previously decided at which end of the building the work would commence, and our superintendent in the field was advised of this fact and was also kept in thorough touch with the progress of the different stages of the steel. As the cars of steel were loaded and shipped out they were put in the hands of the tracing department of the manufacturing company, and our own tracing department as well, and shipments were followed up until they were finally landed at the site. Our tracing department had, prior to this time, made the acquaintance of the different employees of the railroad through whom the records of the movement of the cars were to pass, as well as those who had direct charge at the transfer points. After the steel had been delivered the rest of the work was a mere question of brick, mortar, sand, gravel, cement, window frames, sash, roofing material, and sufficient workmen. Of course, there were large quantities of all these materials required and in order not to delay the work it was imperative that certain amounts of the same be delivered and put in place prior to the delivery of the steel.

Statler Hotel, Cleveland, O.

The same general method was applied to the construction of the Statler Hotel, except that the work was much more complicated and required many more details. There were approximately 90 sub-contractors and material men in and around the building from almost the day it was started until its completion, and it required a great deal of patience, perseverance and hard work to get the different trades to dovetail into each other throughout, so that those who did the preparatory work would finish and leave in time to permit the finished material to be erected in a proper and substantial manner. On the Statler Hotel we found it necessary from about the first of June until a few days before the building was turned over to Mr. Statler, to insist on daily meetings of all of the sub-contractors on the work, together with the architect's representative and others interested in the building. At these daily meetings each trade was taken up separately with the principal representatives of all the other trades present. He was questioned regarding the progress of his work and was told to state whether or not he was being retarded by any of the other trades. If it was found that his work was being hampered he was made to state explicitly and in detail to what extent and how.

The advantage of having all of the subcontractors together at one time can readily be seen, as it eliminated innumerable quarrels between the foremen of the different trades and many misunderstandings which invariably arise due to the fact that the workmen and foremen are not always capable of expressing their troubles in an intelligent manner and, when they are busy, many times do not take the trouble to express themselves at all. It was rather hard to get them to continually attend these daily meetings, as they were held in the evening after they were supposed to be through with their work. We always tried to make the meetings as pleasant and as short as possible and never permitted ill-feeling to exist between the several trades arising from the discussions at the meetings. A typewritten report of each meeting was posted on the general bulletin board so that each of the sub-contractors would have access to the same during the following day.

The following points were brought out by Mr. Stuart in the discussion of the original paper:

Lump Sum or Percentage Basis for Contracts.

If we can get contracts under reasonable competition, we much prefer to do work on the lump sum basis ,as the work is then entirely in our hands and whatever we can save by any unusual attention or ingenuity is ours. However ,if there is a chance that the competition will not be fair, and we are after the job pretty hard, we are glad to take it on a commission basis. A great deal depends on conditions. If the contractor is thoroughly honest, and when I say "thoroughly honest" I mean if he has real conscience, then it seems to me that a commission basis is the best on which to operate from the standpoint of the owner, because he gets exactly that for which he pays.

When we take work on a commission basis, and we do a great deal of that work in Pittsburg, we make up an estimate of the actual cost of the work and tell the owner how much he is likely to expend. We do this for two reasons: One is that we do not want our organization to get into the habit of making any difference whether it is on a commission or a lump-sum basis. If you give the owner an estimate of his building, then it is everybody's purpose to keep within the estimate. The other reason is that we think it is only fair that the owner should know what the building is to cost, and we sometimes guarantee that work will not exceed a certain maximum sum.

The owners should be satisfied even though it may be a little more expensive to have the work done on a commission basis, as it saves them in other ways. For example, it gives the owner a chance to make changes and to have the work done in just the way he wishes, so as not to interfere with his business. Personally, I do not think it costs any more to do the work on a commission basis, especially if the contract covers several buildings or a long period of time. We now have three contracts on a commission basis which are yearly contracts, that is, unless they are canceled before the close of the year they carry over to the next year.

I think the principal objection to percentage work is that the owners do not sufficiently trust the contractors. I know many honest contractors, but just as in other business there are some who are not honest.

We sometimes let some of the work to sub-contractors on a commission basis, but never when the work is of such character that it must be prepared away from the building, such as mill work, steel work, ornamental iron, etc. We have done our own plastering work, but we do not find it very advantageous, because most sub-contractors look after the work themselves as foremen. Fireproofing, painting and other trades are usually sub-let. Most people agree that to get some one who knows how to do it is worth the profit they pay to the contractor.

Value of Creating Interest.

It is essential that sub-contractors and all others connected with a piece of work shall take interest in facilitating the work. Little progress can be made unless everyone is doing his part. We sometimes go so far as to stimulate interest among those furnishing the materials. For example, some one may be sent out to meet the superintendent of the brick plant, from whom the bricks were bought. In fact, our representative may meet the man who writes out the bills and also the man who loads the cars. To be more specific, during the construction of the Statler Hotel we had a man at the stone quarry who saw that the stone was shipped just as we needed it; he stayed there two or three months. The lower courses were shipped first, but even then we paid a large demurrage.

(It is interesting to note the effect, upon the relations existing between the sub-contractors, of the "follow-up" method used by the general contractor in the case of the Statler Hotel. The following is a part of the discussion by Mr. V. G. Marani, who was building inspector of Cleveland during the construction of this hotel.—Editors.)

During the construction of so large a building, especially if the contractor sometimes pushes the work to the inconvenience of the sub-contractors, all kinds of intricacies may arise, most of the trouble being broght about by the action of one sub-contractor against another. The steel contractors, feeling that Mr. Stuart was rushing them a little too strongly, endeavored to have the building department criticise and find fault with the fireproofing, so that by stopping the fireproofing contractor the steel erectors would gain time to work ahead of the fireproofers. The same trouble was experienced with the plumbing contractors, and unless a building inspector is just and reasonable in his judicial capacity, no end of trouble and expense might be caused to the general contractor and to the owner.

Detailed Estimates.

Estimating is becoming more and more standardized. A great many estimators figure work on the same basis. The estimating in Europe is done by professional estimators, or surveyors, as they are called. In England one surveyor will make an estimate and give it to the different contractors. I think it has been attempted here a number of times, but it does not seem to be satisfactory.

In making our estimates we obtain the price of cement delivered; we get the cost of the aggregate; we obtain from the specifications the amount of cement required and the ratio of the concrete mixture; we figure minutely just what the material is going to cost; and we then add the cost of the labor. For the reinforcement, we get the prices per pound, and then compute the amount of reinforcement required for the entire job. The principal element of variation in reinforced concrete is with the wooden forms. We figure the number of feet of lumber which will be required for the framework for the entire job. We do not try to compute the formwork at so much per yard, as it will vary on different buildings, depending on the thickness of the slab, and on other details which vary with every job. It ought, theoretically, to vary almost every day.—*Engineering and Contracting.*

THE MUCH ABUSED, LITTLE APPRECIATED AND GENERALLY UNDER-ESTIMATED CONTRACTOR.

By Henry A. Hoyt.

THERE are few commercial enterprises that entail as much red tape or restrictions of a legal character as the building industry. Erecting a building, under contract, is simply a mercantile transaction; the owner buys a house for a certain sum of money, the cost being determined by a set of drawings and a more or less complete set of specifications. Buying a suit of clothes or an automobile is a very similar transaction, yet how vastly different after all! Your tailor requires a deposit before the cloth is cut, the auto agent usually takes a little of your coin from you before the order is wired East. What a joke it would be if a building contractor required a deposit from the owner before he would cut the lumber or "pour" the concrete.

Under the very strict legal requirements of the building industry as practiced in California, the poor contractor must furnish a bond for fifty per cent of the presumed (?) value of your house, and then leave another twenty-five per cent with the owner thirty-five days after the kind owner has said, through his architect, that he liked and approved of the size and color and fit of the new residence made for him. Seventy-five cents of every dollar is the amount of actual protection the owner legally receives from his builder. Then another important phase enters into the transaction; the owner employs an architect. This person is the expert, the referee, the umpire—and his powers are usually supreme and above the "recall and referendum."

When all three of the parties to our building operation are fair and honest, and the plans and specifications complete and fully adequate, then there is no reason why all should not be brought to a pleasing consummation, with a happy owner, a proud architect and a satisfied builder. However, when any one or two of the three parties involved are unreasonable or unfair, (we will not say dishonest), then many are the complications ,troubles and often legal entanglements that surround the simple act of "selling" a house from builder to owner.

The writer has no real remedy to offer to the conditions as they exist. The industry will probably continue on indefinitely just as it is without any material changes. Those interested can take the facts herein huddled together and make a mosaic of them that will give a right picture of conditions as they actually exist.

Incidentally, however, the industry is seemingly enhanced with more restrictions each year. Mention need only be made of legislative occurrences of a few years and months back,—increase of bond from twenty-five to fifty per cent,—recently, the enactment of compulsory workmen's compensation. One is inclined in a retrospective view to wonder what next will be added to the already overburdened builder.

Using the rule and not the exception as an argument, builders as a class deserve more credit and recognition than they receive. They seem to be brave as well as foolhardy. All of them are gamblers, no matter how much care and study is given the all important item of costs.

If a builder with real "gray matter" gives you a close price on a building, let us say in strong competition, he takes a chance, and the wise builder knows it. Did you ever meet or know a builder of much experience who would not admit of losses as well as gains? The causing of losses by ignorance, error, or shall we say, "bull headedness," are not considered.

How many owners would build should they be called upon to take the builders' chances? Or to go a step farther and ask, how many conservative bankers would loan money to improve real estate were they not surrounded by the strong legal safeguards that place all the elements of chance or risk on the builder and his bond?

The builder would undoubtedly be happier in his chosen field of trouble and chance if he received more recognition in general, and credit for the final results derived from his enterprise and sagacity.

Publicity organizations seem to fall over each other to get factories and industrial plants located in their community. Special meetings are held, free sites are offered, sometimes a coin bonus is raised as a special inducement. How startled a builder would be if he were "approached" by a public committee and offered an "inducement" to locate in some community. He usually has to induce himself to so locate.

A federal building was erected in a California city, and as it happened by local contractors. During a period of eight months thirty thousand dollars was expended locally, directly and indirectly for labor only. It would have to be quite a fair factory to have even a like payroll in the same time, and the money certainly went to more people than through the factory. In this case, the local press, "took occasion to remark," on the public spirit of the local congressman and others who "boosted," but the grit and ability of the contractors who finally saw it all through, and took all the chances was entirely overlooked.

Frequently permanent enterprises result from the impetus received from some good sized building operation. A county hospital contract was let a few years ago in one of California's then new counties. A trunk line railroad was just beginning to open up the county to its possibilities. The contractor made his first trip into the county in the caboose of a freight train, taking a whole day for the forty-mile trip with the frequent stops. A few months later he came out, when the job was completed, in a Pullman sleeper. Facilities concerning availability of building materials were certainly problematical. A good road was built to get sand and gravel and it is still

used for that purpose. The site selected on the railroad siding for unloading materials has since become the freight depot. The contractor bought wisely in car lots, lime, cement, brick, shingles, etc. Naturally much material was left over. This was left with the one-horse dealer and sold on consignment. The small stock of materials opened the eyes of the local people to further building possibilities, and the result, aided by the railroad, is a large and very flourishing building material business. The contractor did his own plumbing, and the young plumbing foreman "imported" for the job somehow "stuck" and is now a full-fledged local plumber doing a nice business and incidentally married to a local daughter.

Builders are not expecting much reward in the way of public praise and recognition and they certainly do not get it. The business of a builder is an independent one and has many compensating features to offset the many obstacles.

Perhaps, when the builders have all (?) gone to the realm where St. Peter is at the head of the Board of Public Works, some of the ideals will be realized. All architects will be fair and reasonable, owners will not think extras are "hold-ups," bonds, lien laws and thirty-five day payments will have been forgotten, roofs won't leak, no waterproofing problems, and finally a price for the work commensurate with the elements of chance encountered and undertaken.—*The Architect and Engineer.*

Engineering Law

Contributed by Wm. B. King

Attorney at Law, Washington, D. C.

Decision of the Supreme Court of the United States, April 6, 1914, in the case of Hollerbach & May vs. The United States.

The decision of the Court of Claims against the contractor was reversed by the Supreme Court, holding:

1. Where the specifications for repair of a dam say that the existing dam is "now backed with broken stone, sawdust and sediment," and it is actually backed with solid crib-work, the Government must pay the increased cost of removal, notwithstanding other provisions in the specifications notify bidders to visit the locality, estimate difficulties and obtain information necessary for an intelligent proposal.

2. The contractor has a right to rely on a positive assertion of such a fact without an investigation to prove its falsity.

King & King, of Washington, D. C., appeared for the contractors; Assistant Attorney-General Huston Thompson appeared for the United States.

Mr. Justin Day delivered the opinion of the Court.

This suit was brought to recover upon a contract between the appellants, doing business as Hollerbach & May, and the United States for the repair of Dam No. 1, Green River, Kentucky. In the aspect in which it is now presented the question involved concerns the right of the claimants to recover because of certain damages alleged to have been suffered by them which would not have acrued had the dam been backed with broken stone, sawdust, and sediment, as was stated in paragraph 33 of the specifications attached to the contract.

The determination of this controversy requires reference to certain parts of the contract and the findings of the Court of Claims. The specifications provide, among other things:

"20. It is understood and agreed that the quantities given are approximate only, and that no claim shall be made against the United States on account of any excess or deficiency, absolute or relative, in the same. Bidders, or their authorized agents, are expected to examine the maps and drawings in this office, which are open to their inspection, to visit the locality of the work, and to make their own estimates of the facilities and difficulties attending the execution of the proposed contract, including local conditions, uncertainty of weather, and all other contingencies.

* * * * *

"33. Work to be done. . . . The present dam, a wooden crib structure, is 528 feet long between abutments and about 52 feet wide at its base. The expected depth of concrete work is shown on the blue prints, but it may be made greater as the condition of the old timber may render it necessary. The work shall be carried out in sections, generally from 50 to 100 feet long, and no more of the old work shall be torn out than can be rebuilt in a few days in case of necessity. All the exterior surfaces of the concrete shall be faced with the facing described in paragraph 59, which shall be placed before the concrete below has set, and shall be smoothly finished off. The dam is now backed for about 50 feet with broken stone, sawdust and sediment to a height of within 2 or three feet of the crest, and it is expected that a cofferdam can be constructed with this stone, after which it can be backed with sawdust or other material. The excavation behind the dam will be required to go to the bottom, and it is thought that a slope of 1 horizontal to 1 2 vertical will give ample room.

* * * * *

"60. Blue prints. Blue print drawings showing the method of construction may be seen at this office; they shall form a part of these specifications and shall not be departed from except as may be found necessary by the condition of the old timber encountered.

* * * * *

"70. Investigation. It is expected that each bidder will visit the site of this work, the office of the lock master, and the office of the local engineer and ascertain the nature of the work, the general character of the river as to floods and low water, and obtain the information necessary to enable him to make an intelligent proposal."

The Court of Claims found as a matter of fact, among other things:

"As the contractors proceeded with the work of removing the material behind the dam it was found that said dam was not backed with broken stone, sawdust, and sediment as stated in paragraph 33 of the specifications, but that said backing was composed of a soft sclushy sediment from a height of about 2 feet from the crest to an average depth of 7 feet, and below that to the bottom of the required excavation said dam was backed by cribwork of an average height of 4.3 feet consisting of sound logs filled with stones."

The Court of Claims refused to enter judgment for the damages suffered by reason of the difference in the backing of the dam as found by the court, but estimated the damages for the matters in dispute in that respect to aggregate $6.549.23 (47 Ct. Cls. 236).

In the course of its opinion the court below said that if paragraph 33 stood alone it would be a warranty of the material backing the dam. "It was," said the court, "a positive and material representation as to a condition presumably within the knowledge of the Government, and upon which in the absence of any other provision or warranty the plaintiffs had a right to rely." But the court held that the cautionary provisions of paragraphs 20 and 70 required the claimants to inform themselves of the condition of the backing of the dam and that when those paragraphs were read with paragraph 33 the statements and representations of the last named paragraph could not be regarded as a warranty upon which the claimants had the right to rely, and the court reached this conclusion upon the authority of certain cases of its own and Simpson v. United States, 172 U. S. 372.

In Simpson v. United States, supra, suit was brought upon a contract for the construction of a dry dock at the Brooklyn Navy Yard. It was discovered that the foundations upon which the dry dock rested contained quicksands which were unknown and which were not shown in the drawings and plans inspected by the contractors before the making of the contract and upon the strength of which the contractors had made their bid. This court held that the written contract merged all previous negotiations and must be presumed in law to express the final understanding of the parties. Of the contract itself the court said that it was clear that there was nothing in its terms which supported, even by remote implication, the premise upon which the claimants rested their right of recovery; that the contract contained no statement or agreement or even intimation of a warranty, express or implied, concerning the character of the underlying soil at the place where the dock was to be built; that the only word in the contract which supported the contention of warranty was that the dock was to be built in the navy yard upon a site which was "available," and that the word "available" did not warrant against the quicksands which were found, and it certainly did appear that the site was available for the dock was constructed upon it. It is therefore apparent that this case is entirely different from the one now under consideration, in the contents of the contract and specifications made part thereof, and that in the Simpson case the claimants relied upon previous negotiations and information as to the site for the dock, developed in the plans showing the result of an examination made by the Government officers upon a portion of the yard, and did not depend, as here, upon the terms of the contract.

In this case the claimants rely upon the contract, read in the light of the findings of the Court of Claims. Turning to paragraphs 20 and 70 the Court of Claims justified its conclusion in that part of paragraph 20 which provides that "quantities given are approximate only, and that no claim shall be made against the United States on account of any excess or deficiency, absolute or relative,

but the specifications assured them of the in the same. Bidders or their authorized agents, are expected . . . to visit the locality of the work, and to make their own estimates,' etc.; and in that part of paragraph 70 which reads, "it is expected that each bidder will visit the site of this work, . . . and ascertain the nature of the work," etc. The term "quantities" as used in paragraph 20 may doubtless refer to estimates of the amount of different kinds of work which are specified in the contract. We do not see how it could control the statement of paragraph 33, definitely made, as to the character of the material back of the dam. Pertinent parts of the paragraphs referred to would seem to be those which required bidders or their authorized agents to investigate for themselves and to visit the locality of the work to ascertain its nature and make their own estimates thereof. The specifications attached to the contract set forth the work to be performed in great detail, as to its nature and character, and many particulars as to manner and extent of the work to be done, the removal of old timber and material, etc., the general character of the river as to floods and low water, etc., and the difficulties attending the execution of the contract, and as to all these things the bidder was required by paragraphs 20 and 70 to make examination for himself and at his own peril.

In paragraph 33 the Government sets forth with particularity a description of the old dam, its length and width, and it was there added: "The dam is now backed for about 50 feet with broken stone, sawdust and sediment to a height within two or three feet of the crest," etc. The specifications provided that the excavations behind the dam must be to the bottom. In the light of this specifiation, turn to the finding of fact, and we learn that the claimants, as they proceeded with the work, found that the dam "was not backed with broken stone, sawdust and sediment as stated in paragraph 33 of the specifications," and below seven feet from the top to the bottom there was a backing of cribbing of an average height of 4.3 feet of sound logs filled with stone. Obviously, this made it much more expensive to do the work than if the representation inserted by the Government, in the specifications of its own preparation had been true and only the character of material had been found which the specification unequivocally asserted was there.

A Government contract should be interpreted as are contracts between individuals, with a view to ascertaining the intention of the parties and to give it effect accordingly, if that can be done consistently with the terms of the instrument. In paragraph 33 the specifications spoke with certainty as to a part of the conditions to be encountered by the claimants. True the claimants might have penetrated the seven feet of soft slushy sediment by means which would have discovered the log crib work filled with stones which was concealed below, character of the material, a matter concerning which the Government might have presumed to speak with knowledge and authority. We think this positive statement of the specifications must be taken as true and binding upon the Government, and that upon it rather than upon the claimants must fall the loss resulting from such mistaken representations. We think it would be going quite too far to interpret the general language of the other paragraphs as requiring independent investigation of facts which the specifications furnished by the Government as a basis of the contract left in no doubt. If the Government wished to leave the matter open to the independent investigation of the claimants it might easily have omitted the specification as to the character of the filling back of the dam. In its positive assertion of the nature of this much of the work it made a representation upon which the claimants had a right to rely without an investigation to prove its falsity. See United States v. Stage Co., 199 U. S. 414, 423.

It follows that the judgment of the Court of Claims must be reversed and the case remanded to that court with directions to enter judgments for the claimants for the damages incurred because of the different character of material found behind the dam than that described in the specifications.

Accounting Department

Conducted by Harry M. Smith*
Certified Public Accountant.

Following the practice of the past few months, another article on the important subject of costs is submitted in this issue. This one having been written by Mr. Lindon Bates, Jr., and is reproduced in full from "System."

After presenting as many articles as may be obtained that bear on the subject of Contractors' Cost Accounts, it is the intention to discuss them and to endeavor to draw certain conclusions from each.

It is perhaps reasonable to state that the experience of the several writers, whose articles have been reproduced, has been along lines that differ materially and as a consequence, just so many view points of the one general subject have been obtained. Therefore by combining certain of the ideas that have been expressed, and it is well to remember that all are giving the results of practical experience, a system may be produced that should prove fairly complete and satisfactory.

Mr. Bates' article follows; it was published under the caption: Getting more from cost of figures: A two form progress report.

Cost records so thoroughly systematized in manufacturing plants and mercantile establishments, have been slighted by contracting organizations. Many of the most skilful and successful contractors submit their bids and finish construction work without the accurate knowedge of conditions and costs requisite for the manager whose work is in progress in half a dozen different localities. Daily the question arises, "Are we making the estimated profit on the big piling contracts?" and so forth.

Without systematic records the executive can have no real measure of efficiency. He can guess; he cannot know. To furnish accurate information the better managed organizations have developed two report forms: the first, the daily follow-up—a history of progress on each job; the second, a monthly cost record. The daily report keeps the executive in touch with work going on; the monthly report gives a record of costs to serve as a basis for calculations and to sum up results for the period.

The first aim of the daily report is to give a record of operations and results. The more vividly it portrays conditions, the better it serves. To accomplish this, the number of men on each job is recorded, not, for example, as "123 labor hours on second-class concrete. Division A3," but as "12 laborers building concrete abutments for Roberts Bridge.' The latter statement is far more easily grasped when the reader is miles away from the work. Indeed, the most complete reporting systems, giving daily costs to the third decimal of a cent, have proved unsatisfactory, because they have not conveyed a real picture. For while the "labor hour" is mathematically accurate, the human mind fails to translate it into a picture of working conditions.

Brevity in the report also adds to its vvalue. If a daily report covers several pages it usually includes unessential details, and under pressure of routine business the busy manager cannot devote any great time to poring over pages of statistics. He must grasp the situation at a glance, and needs only simple records of results.

To meet these fundamental requirements the daily report of "Labor, Plant and Work Done," has been evolved, one sheet for each day, thirty-one bound together as a monthly book. The original white sheet, signed by the compiler and the local superintendent, goes to the central office by the first mail, the yellow carbon copy being retained at the job. The reports of each month, bound in a separate cover, are filed in the Central Office. A simple report (Form I) represents the composite idea of half a dozen superintendents in close practical touch with construction problems and of as many executive officers, who have spent weeks of work inspecting hundreds of proposed reports and carefully planning every space in the form chosen.

But the proof of a record is that it can be read. Imagine the president of a great construction company back from a month's inspection trip—say of a proposed harbor work in Mexico. He must be able to put his finger on the very pulse of the business. When he returns to his desk the reports of the previous day from Contract No. 6 are given him. He reads "Dredge 'Peconic' three shifts, 1,500 yards; 'Pontiac,' 1,820 cubic yards—three shifts——" both a fair average output. "Total excavation in the month carried forward 26,400 cubic yards"—and so on. In ten minutes he is in touch with everything that is going on.

Monthly reports complete the check. Estimates of work done and payments therefor are made by the month in all state contracts, and almost invariably on railroad and other corporation work. Unless the law provides to the contrary, labor is likewise paid monthly and payments for supplies, fuel and other items are similarly made.

The monthly report (Form II) must show the "quantities" achieved "during the month," and "to date" on the contract specifications, as well as "costs." This information comes from the pay roll and the

*Asso. Member of the Society.

ledger, proper payroll distribution giving the wages of each gang and the labor costs of each "work-unit." All material is charged against a regular account number for distribution. Since these ledger entries charge to the same work-units and give true material costs while the pay rolls give the labor costs the two elements are accurately set forth for future use.

The first item on the monthly record is "clearing," the engineer entering opposite this head the percentage for the month, and to date. Two columns are given—one for material and one for labor cost. "Grubbing" is the second item. The payroll gives the number of men and the wages paid, the ledger charging their axes, mattocks and shovels to account "clearing and grubbing." The record is complete without further subdivision; and "unit costs" and "per cent of total" are available for both the executive report used in planning future work and the cost records.

The third item is "all excavation," paid for by the cubic yard. Here careful differentiation must be made; for by pick and shovel a certain material may cost one dollar a yard, by dipper dredge, 16 to 25 cents, by scraper, 27 to 35 cents. To have these dissimilar elements grouped under one head "excavation," would give no reliable data. Even a cost record under the head "dipper dredging" would mislead. For while one dredge is working against a clay bank at one unit cost, another may be working in the river bed at nearly three times the expense. For true costs, the elements must be resolved into the lowest terms. The "dredge 'Pontiac' dredging rock;" "rock cutter 'Tioga,'" "rock excavation by hand," "earth excavation by hand," are therefore by analysis, the headings which give true costs when labor and materials items are correctly charged.

Here the contract superintendent intervenes :"How does the cashier at the office know where the boats are digging.. He can't tell if the coal and oil we send down to the Pontiac from day to day is charged to 'digging rock' or 'digging dirt.' Can't we charge it to each machine?" And he is right. The report states the nature of material, but the charges are made to the various machines, scows, and so forth. So, for final analysis of the single item "excavation," the contractor is obliged to carry six main heads, subdivided to give all the cost elements separately—the dredge "Pontiac," dredge "Peconic," rock cutter "Tioga," tugs, scows, miscellaneous excavation, and so forth. The excavation charge is worked out as in the specimen sheet.

Three items follow: "1st class concrete, 2nd class concrete, 3rd class concrete." These three grades vary only in the relative percentages of cement, crushed stone and sand which they contain. One batch of third class may be put through the mixer at 10:30 a. m., and run down to the abutment by wheel-barrow, three batches of second may be hurried down at 11 a. m., and at 11:45 two batches of first. In such a situation it is practically impossible for any ledger clerk, or timekeeper, to figure accurate costs. In building a dam across the Hudson one company did try to charge labor and material. The following shows the result:

	Ledger Record of expenditures.	State estimate of quantities in place.
1st Class Concrete	$ 54.27	$ 5,483.90
2nd Class Concrete	38,664.69	14,725.12
3rd Class Concrete	....	1,815.50

Receiving five thousand dollars for work "costing" $54.27 was only capped by the tragedy of receiving fourteen thousand dollars for work "costing" $38,664.69. And it was the fault not of the clerk who was given an impossible job, but of unaccountable cost heads. Total payments versus total expenditures—showing the record of profits and the market price of cement, however, give a reasonably reliable index of the profit coming from each grade of concrete. Wash wall and coping, stone filling and rip rap are items appearing in nearly all contractors' schedules.

Finally the timber used to make up pile decks, and pile bank protection must be recorded. Here the official headings, "yellow pine timber," "round timber" and "mooring piles," "iron and steel fastenings," need be combined rather than subdivided. Since the same laborers fit the timbers, drive in the iron fastenings and install the planking, their joint work must be charged to one heading, "crib work." The profit on the different timber items, like that on the three grades of concrete, must be reckoned from the total costs of the crib work, and the market cost of materials. The monthly report must therefore include a schedule of timbers, logs, fastenings, cement, and sand, showing the amount used for each job, the market cost, and the stock on hand.

The contractor desiring further data must then add items to cover the general expenses. "Preliminary and advance work," executed to prepare the way for actual operations — expenditures for building

Contract No. 6 — Watertown Ohio — DAILY REPORT — Date July 17 1912 — Weather Fair

Account No	Class of Work	Location Sta No	Shifts	Walking Bosses	Foremen	Operators	Engineers	Firemen	Ships Crew	Watchmen	Teams	Artisans	Laborers	Cranesmen	Superintendent	Civil Engineers	Clerks	Cost of Labor and Office	Dredges	Tugs	Scows	Pile Drivers	Concrete Mixers	Excavation C.Y.	Piles Driven	C.Y. Concrete	Holes Driven	Remarks
3-a	Dredge Pontiac	334	3			3	1	3	6				1	3				42.10	1		2			1820				
3-b	Repairs Pontiac				1							2	1					9.70										Repair Gang
4-a	Dredge Peconic	327	3			3	1	3	6				2	3				43.80	1		2			1590				
4-b	Repairs Peconic																	5.20										Crew Repairing
5-a	Rock Cutter Tioga	462	3		1		3	3	9				1					42.30									48	
5-c	Renewals		1		1								3					6.20										Cutter point
6b	Operating Tugs		3			6	3		15			1						72.15		3								
7b	Altering Scows		3		1						2	1	7					35.16										Change to bottom dump
24-b	Storeroom				1						1	3	2					23.95										
21-b	Engineering											2				1		7.20										
20-b	Admin & Office														1		2	8.30										
8-b	Spoil Area #1									1								2.00										Taking up track
14	Concrete Abutment Robert Bridge				1								10					24.00										
	Totals for Day				6	12	8	4	36	1	3	9	27	6	1	1	2	322.06	2	3	5			3410			98	
	Brought Forward																	5681.10						23050			3,001	
	Month to Date																	6,003.16						26460			3,099	

Compiled by Howard P. Puckitt — Approved by H. N. James, Supt.

FORM I: Compiled after many weeks of careful study, this form finally adopted as the best method of making up a comparative daily report of costs and work done. One card answers for each contract, and on it is given a complete account of every phase of all operations performed during the day. Couched in simple language, the report gives the executive reading it an immediate picture of what was actually done.

MONTHLY REPORT AND COST RECORD — Contract No. 6 — Watertown Ohio — Month of June 1912

To be mailed to New York before the 5th of the month

Acct No	Items	Output Per Month	Output To Date	Monthly Costs Labor	Monthly Costs Material	Unit
1	Clearing per cent		.50			
2	Grubbing c.y.		3027			
3 a	Dipper Dredge Pontiac Operation Total c.y.	35000	31624	1444.00	306.20	.05
	Total hrs. 371 Rock hrs. c.y.		520			
	Coal used 130 Tons Earth 371 hrs. c.y.	35000	31104			
b	Repairs 40 hrs.			441.60	52.00	.014
c	Renewals 11 hrs.			150.00	25.95	.005
4 a	Dipper Dredge Peconic Operation costs Total c.y.	21000	21000	890.00	210.00	.10
	Total hrs. 280 Rock hrs. c.y.					
	Coal used 70 Tons Earth 280 hr. c.y.	21000	21000			
b	Repairs 48 hrs.			401.60	20.30	.02
c	Renewals hrs.					
5 a	Rock Cutter Tioga Operation costs			560.49	130.10	.50
	Total hrs. runs 160 Amount broken c.y.	380	1380			
	Coal used 40 Tons Area shattered Sq. ft.	8460	8460			
b	Repairs 26 hrs.			3.00	.80	.01
c	Renewals hrs.					
6	Tugs Operation			1527.40	441.10	.43
7	Scows Operation					
8	Spoil areas Operation					
	No. 1 Cranes 2 Locomotives 2 Cars 8	5016	5016	320.02	121.16	.10
	No. Cranes Locomotives Cars					
	No. Cranes Locomotives Cars					
9	Miscellaneous excavation c.y.		36520			
10	Forming embankment c.y.	320	8289	130.26		.43
11	Cribs timber and pile work lin. ft.					
12	Bank protection timber and pile work lin. ft.					
13	Stone filling c.y.					
14	Concrete — Roberts Bridge Abutment					
	First class 17 c.y. per mo 837 c.y. to date					
	Second class 120 c.y. per mo 2400 c.y. to date					
	Third class c.y. per mo 316 c.y. to date					
	Aggregate for all classes	232	3553	629.11	365.96	4.21
a	Auxiliary construction Cofferdam			47.80	6.11	.36
b	Making forms			21.30	14.50	.15
c	Material sand cement stone and bars			34.20	143.20	.76
d	Mixing			95.50	61.15	1.06
e	Transporting and placing concrete			310.21	121.00	1.81
15	Wash wall and coping c.y.					
16	Miscellaneous buildings and construction			240.00	321.00	
	Carried forward			8386.59	2417.48	

Acct No	Items	Output In Month	Output To Date	Monthly Cost Labor	Monthly Cost Material	Unit
	Carried forward					
17	Preliminary and advance work	27400	285463	8386.59	2417.48	
18	Miscellaneous plant a Repairs [illegible]			443.66	188.97	
	b Renewals				69.92	
19	Additions to plant New Tug			819.45	728.51	
20	Administration and office expenses			521.30	82.40	
21	Engineering and drafting			720.93	27.90	
22	Traveling expenses — 2 Boston w spares for Dredges				120.34	
23	Tools				81.22	
24	Storeroom			106.30	422.11	
	Miscellaneous and minor making up total					
	Total contract outlay			11061.83	4133.85	
	Engineers estimate of earnings	$29,875	233,826			
	State estimate leave blank	29763	232510			
	Credits and sales 4 Cords Wood @ $12				$12.00	

REMARKS: Dredge Peconic just starting breaking in new crew. Rock Cutter Tioga started on two shifts. New Pier built at Station 365 to unload coal.

SCHEDULE OF MATERIALS

Items		Delivered in month	Market Cost	Used for Pier	Used for	Used for	Used in month	Used To date	On hand
Yellow Pine	fbm		$.08						
Round Timber	ft.			80 ft.			180	180	5320
Mooring Piles	each								
Fastenings	lbs.								
Sand	c.y.		.63					2130	6800
Cement	bbl.		1.56					4320	
Stone	c.y.		1.15						900
Stone crushed	c.y.		1.45					5239	
Bars	lbs.						340	3795	1030
Coal	tons		3.50						

Engineer Howard P. Puckitt — Approved H. N. James, Superintendent

Cashier Arthur Hoyt — Date July 3rd 1912

FORM II: Naturally more comprehensive than the daily records, this monthly report affords a check against it, and gives the executive at a glance a complete account of the month's work. Like the daily report, this sheet has each operation described in simple terms which picture the work; and they make it very simple to pick out the places where there have been leaks or especially good records.

levees, or for leveling the beam along which a pile-driver travels, and so forth; "administration and office expenses," "engineering," "additions to plant," "traveling expenses"—such captions as these must also be on record from month to month. Finally, the total contract cost for the month is inserted. The engineer's estimate of the month's earnings is put below this head and a blank remains for the estimate of the engineer employed by the state, city or corporation, and so forth. The contract cashier—responsible for cost record—and the engineer, responsible for quantities—both sign the report. The contract superintendent—responsible as commanding general—finally gives his approval.

Eliminating the Irresponsible Builder.

FREQUENTLY considerable trouble is caused and unnecessary expense incurred through the acceptance of the bid of an irresponsible bidder. In his anxiety to obtain the contract, he tenders at a low figure, and with the award of the contract his troubles as well as those of the owner begin. He soon recognizes the fact that his prices are low and skimps the work where possible or uses materials not specified. Even with close inspection it is not always possible to prevent this.

Time is always an important factor in any contract. The contractor of limited contracts in competition with men who are an expenditure of both time and money. That many firms will not bid on certain means is not infrequently inefficient in executing his contract. He lacks the system and the equipment by which the work can be carried to a speedy conclusion. He finds difficulty in financing and the work drags to the annoyance and loss of all concerned. The contract is abandoned, occasionally a lawsuit follows and somebody else must be called in to finish the work.

A first essential in providing a remedy for this condition is a recognition on the part of the owner, that an article obtained at a low price is not necessarily a cheap one. That even if the owner should desire it, he cannot get something for nothing and that there is an economy in paying a reasonable price and having the work done by responsible persons

The standing of the individual or firm to whom the contract is to be awarded should be known, and if the owner is not thoroughly satisfied,. the award should not be made.

The difficulty may be obviated by inviting firms to bid on a given piece of work. In this case the owner should be perfectly frank and let the firms know against whom they are competing and reasons should be given for the acceptance of any bid.

It should always be borne in mind that in bidding on any piece of work there is bound to have the work at any hazard, knowing that expense is involved without possibility of return.

This state can be remedied only by a system of bidding necessitating the least possible outlay on the part of those bidding. It seems to us that a general adoption of "The quantity system of estimating" as advocated by Mr. G. Alexander Wright would go a long way in this direction. By this means the cost of bidding would be minimized and the possible variation in the bid price reduced to the very narrowest limits.—*Contract Record.*

The Lucky Hunch.

THE other day a Chicago Contractor was preparing his bids on three paving Contracts. He had decided that he would submit the same price—$1.43 per square yard —on the pavement proper on each job. As he was preparing to put down the figures on the estimating sheets-the telephone bell rang. He took down the receiver and prepared to listen. There was some delay at the other end of the line, so while waiting he absent-mindedly began marking the sheets. He set down $1.43, $1.43 and $1.42. After he had finished his telephone conversation he took up the blanks and noticed his mistake. "I'll let it go at $1.42" he said: "maybe it's a lucky hunch." It was, for that particular bid secured a $10,000 contract by the narrow margin of 35 cts.—*Eng. News.*

Employment Bureau

Men Available

Actuated by a desire to be of direct assistance to all its members in securing better positions, the Society earnestly solicits applications both for positions and for men available. This department is under the personal supervision of the Secretary, and all applications are carefully numbered and placed on the file at the headquarters of the Society. The list of men available is made up wholly of members of the Society, and as such is entirely dependable. In communicating kindly address Employment Bureau.

004 Member of the Society with twenty-six years' active experience; would like position as superintendent. Has a varied and large experience in building and general construction work; steady habits, married, willing to go anywhere. Speaks Spanish. Can furnish excellent references.

005 Member of the Society with twenty-seven years' experience as superintendent on construction work, foundations, dry-docks, dams, bridge erection, bridge foundations and canal work. Would like an opening as superintendent, preferably in the East. Best references available.

006 Superintendent with twenty years' experience in heavy construction operations, competent to handle large jobs successfully. Good organizer, now open for engagement. Considered a hustler. Any location. Age 43. Practical experience in installation and operation of cableways, shovel, pile-driving and such apparatus. Member of the Society.

007 A neat little organization with $2,000 to invest, consisting of a competent ESTIMATOR, with four years' successful record (Member of the Society) and a superintendent mason, and a carpenter with four years' success in handling concrete work, desire association with an experienced contractor with sufficient financial resources. Write to the Secretary for further particulars.

008 Charter Member of the Society. Employment desired with a railroad company on maintenance of way, revision or appraisal work, or position with a construction company. RECORD: Civil Engineer. Twelve years' railroad work as transitman. Engineer. Roadmaster. Engineer of Maintenance Way. Last five years and at present a member of a construction company engaged in heavy foundation and reinforced concrete construction.

009 Member of the Society. Student graduating as Civil Engineer in June, desires position with construction company. Would prefer work in charge of concrete gangs. Has had two summers' practical experience in concrete work as follows: Bent and placed reinforcing rods, run a concrete mixer, charge of concrete gang. Handled the instrument, laying out buildings, giving lines and grades and figured quantities of materials required.

010 Junior Member of Society, 27 years old, married; 8 years' experience on building and development construction. Excellent record and references. At present employed in resposible position by big company with whom he has been employed over four years; have worked up from time and cost keeper. Experience in building estimating. Desires opening with individual or small firm doing building and general construction where there is the greatest opportunity for office and field work—estimating, ordering, supervising, etc. Would appreciate interview and can be reached through the Secretary, who will also give any further information.

PROFESSIONAL CARDS

HALBERT P. GILLETTE

Appraisal and Efficiency Engineering

15 William Street, New York City
608 S. Dearborn St., Chicago

J. H. TROMANHAUSER, Ltd.

Engineer and Contractor

604 Temple Bldg. Toronto, Can.

Concrete Grain Elevators and Docks

Write for Pamphlet on Concrete Docks

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, SEPTEMBER, 1914 Number 9

A SERMONETTE ON ADVERTISING

PROBABLY the best of the many definitions of advertising is this: "The art of making a favorable impression on the minds of possible buyers." That is all there is to it—but that's an awful lot.

¶ There are several branches and sub-branches of advertising. One of the main branches, and the branch that is making the most rapid progress, is the kind known as trade or technical paper advertising. This kind of advertising is the least expensive, the most direct, and the most efficient of all. This is true because a trade paper is devoted to **one** particular industry and very naturally acquires as readers only those men who are interested in that industry. The manufacturer who wishes to do business with this class is therefore able to reach his possible buyers direct and without buying waste circulation.

¶ Another definition of advertising is "an auxiliary salesforce," and this is a pretty good definition too. Suppose you are a machinery salesman. When you attempt to make a sale there are three steps to be taken. You must first get attention, then interest, then desire. After the desire stage is reached, if prices and delivery, etc., are satisfactory, the sale is made. Now advertising helps the salesman past what may be called the three preliminary selling steps. It does an advance work for the salesman as well, and sometimes better, than he could do it himself, and to an infinitely greater number of people.

¶ Advertising begets confidence. As a very simple illustration of this, suppose there was no salesman within gunshot of you, but before you stood two rock drills, one of which you must buy within the next five minutes. Assume that the cost of these drills is the same and that they are the same in size and type, in fact, identical as far as you can see. One is labeled Ingersoll-Rand Company, and the other Jones & Smith Company. What chance would the Jones & Smith drill have with you? Not much, in fact it has been proven many times by actual test that only once out of a hundred times would you take a chance with the Jones & Smith product. Why? Simply because you don't **have** to take a chance. You know about one, you don't know about the other.

¶ Publishing a trade or technical paper is a precarious though interesting business. The thing that makes it possible to publish a trade paper at all is advertising, and the thing that makes it possible for a manufacturer to economically advertise—without waste circulation and to a selected class of people—is the trade paper; they **must** go together. Given sufficient advertising, which means financial independence, and a paper that stands for a principle becomes a power in the land. Given purpose and the finest editorial equipment in existence but insufficient advertising, and the paper dies surely and quickly.

¶ Advertisers themselves are peculiar. You would think that a hard-headed business man would make an effort to find out what constitutes advertising value, but he does not—not very much. A skilled advertising solicitor can sell space in a very poor paper. The finest paper printed could solicit advertisements by mail and starve to death doing so.

¶ There are several things that constitute advertising value in a publication but the one big thing that makes a paper valuable as an advertising medium is having enough of the **right kind** of readers. That is the heart of the whole matter. A publication may be a very remunerative advertising medium and yet have a very small circulation. The greatest factor of success in any branch of business is co-operation, so when the readers of a paper, even though they are very few in number, have a friendly interest in the publication itself and a desire to see it prosper, that paper is sure to be a power for its advertisers.

¶ In his secret soul no advertiser cares very much what constitutes advertising value in the publication so long as he is sure that the value is there. He wants to sell his goods and he doesn't care a tinker's dam what the influence is so long as it results in a sale. Suppose that only one hundred members of the American Society of Engineering Contractors should decide to favor those firms who advertise in the Society's paper, which, by the way, they would have a perfect right to do. What do you think would happen? This: The Engineering Contractor would immediately become the most popular sort of advertising medium, and in about three months' time there would be coming into the Society's treasury sufficient revenue to enable the Society to do quickly, instead of by the process of a slow and tedious growth, all the fine things which the Society stands for, and has under way. The Society would not have to write any more letters soliciting advertising—it would come of its own accord.

¶ Any advertiser knows that if only one per cent. of the circulation of any good paper, Engineering News or Engineering Record, for example, were actually determined to have his goods and no one else's, he could well afford to pay the total advertising rate for that small part of its circulation. The members of the American Society of Engineering Contractors have within themselves a power for good which they do not appreciate. There is considerable food for thought in this for every member who happens to read this brief editorial.

Waterproofing as a Preservative

By Edward M. Caffall*

THE question of waterproofing buildings and building materials is as old as history. For wood and metal work paint and varnishes as applied today probably will never be superseded. Bituminous products are referred to in many places in Genesis as having been used to keep out water. In Egypt mummies were wrapped in linen or burlap, saturated with pitch, which has served its purpose to this day.

The protection of stone, brick, concrete and other minerals used for building is as far as we know of purely modern origin, excepting that, according to Professor Barff of the British Museum, the ancient Greeks waxed their statues by some now forgotten method and to this their marvellous preservation at this day is due.

Water and air acting together and aided by changes of temperature are the great destroyers. Thus, as every one knows, rocks in their beds below the "water-line" are practically unchangeable, but above the water-line where rain passes gradually through them followed by air as the water recedes, the stone is injuriously affected. This is the reason that quarry men "uncover" their quarries and reject the upper layers of rock. In rainless countries rocks exposed to air action alone are little affected.

The Egyptian Obelisk in Central Park, New York, treated 1885, is still perfectly protected by its hydrocarbon coating.

The action of the weather upon building materials is accelerated by the presence of "building salts." These salts are produced in building materials themselves, and are the result of the passage of water and air alternately through the pores. This water usually contains carbonic acid, especially in the neighborhood of towns and factories, and in addition, sulphuric and nitric acids carried by smoke. These acids have a great affinity for moisture and are absorbed by rain and vapors in the air. The combined attack of all these agencies upon building materials, i. e., heat, front, gases, acids, alkalis, allied with the great destroyer, water, are irresistible to every substance excepting one—paraffin wax, especially when this is combined with that great deturgent to oxidation—creosote.

Paraffin wax belongs to the hydro carbon group which consists of an innumerable variety of chemical combinations of hydrogen and carbon. These run a perfect gamut from gases to liquids and solids.

Solid paraffin wax obtains its name from the Latin word "parum" and "affinis," meaning "little affinity," because it has little or no affinity for any other substance in nature. Hence it can be applied to building materials with a certainty that it will protect them from the attack of the above mentioned enemies.

All bottles in drug stores that contain deliquescent salts, corrosive acids and other energetic chemicals are sealed with paraffin wax. These chemicals remain inert as long as the wax is unbroken. Paraffin is the universal "policeman" in the laboratory (excepting for a few volatile oils, etc.) that keep all warring elements quiescent.

Creosote is the preservative property in smoke that prevents the decay or oxidation of hams and other smoked meats. A quarter of an ounce of creosote in fifteen gallons of linseed oil paint will permanently prevent the drying or oxidation of the oil.

As paraffin wax is colorless it can be applied to all descriptions of stone, brick, cement, terra cotta, etc., without changing the color of the materials.

The joints of a wall are usually vulnerable to the weather, though if properly laid up under favorable circumstances they frequently become stronger than the objects they bind together.

Metal work exposed to the weather, to the action of acid oils and to electric currents have been made to rely heretofore for protection on paints and varnishes, but hydro carbons offer a wide field of investigation and experimentation to the engineer, as they have protective qualities far beyond that of any other known substance.

Colored Marbles for Exteriors.

Highly colored variegated marbles lend themselves to decorative color effects as no other materials do. "I dreamt that I dwelt in marble halls," expresses the highest ideal of a magnificent building. The use of the finest marble has been confined heretofore to interiors principally, because of the destructive effects of the weather. These become apparent immediately on exposure. Architects rarely select these beautiful stones for exteriors, excepting in small panels and in situations where they receive some sort of protection, as under porches, watertables and the like.

These marbles are fragile in their nature, owing to the fact that their beauty is due to what would be called in other stones" imperfections." It is well known that the iridescent colors of the opal are caused by minute fractures. So in these marbles it is the foreign elements fused and blended into the matrix during their formation (such as copper, iron, clays, etc.) that give them their wonderful variety of color. All are metamorphosed rocks. Owing to these features there are veins and fractures of varying strengths and densities and it is here that the weather finds its opportunities of attack.

The selection of these marbles for exterior purposes has always been considered a bold experiment, but business demands nowadays the best effects, regardless of expense, for attractive display.

Fortunately Nature has provided means of prevention as well as means of destruction, leaving it to chemistry, aided by ingenuity, to discover them. The problem of preserving delicate marble is a mild one compared with that of preserving decaying granite, as in the case of the Egyptian Obelisk, which is 3,500 years old, in Central Park, New York. Twenty-nine years ago this problem was solved by Robert M. Caffall by the application of the "Caffall Process" to the stone. To-day the same process solves the problem of the use of any delicate stone for exterior purposes. To-day the business man may indulge in the most expensive and elaborate effects for his store front or office building, with the certainty that the marble he selects will retain its polish and its color.

Some examples of the effectiveness of the "Caffall Process" may be seen on the Italian Cippolino marble columns of

Alexander Hamilton's tomb in Trinity Churchyard, treated 1900, still intact.

St. Bartholomew's Church, Madison Avenue and 44th Street, New York City, treated five years ago; the black and gold Italian marble fronts of the Dreicer Building, Fifth Avenue and 46th Street, New York City, and the Bigelow-Kennard Building, Boston, treated three years ago; the Eastman grey and white marble front of the Theodore B. Starr Company's Building, 47th Street and Fifth Avenue, treated three years ago; and the Alexander Hamilton Tomb in Trinity Churchyard, New York City, Tuckahoe marble, treated fourteen years ago.

The treatment of marble does not add to or detract from the colors, natural or acquired, except to heighten them to a slight degree, making polished marble positively brilliant in effect. The marble in the Dreicer Building, above referred to, has a plate glass effect, so high a polish has it acquired. It is certainly one of the most striking fronts on Fifth Avenue.

The Adams Express Building, 61 Broadway, New York City, the lower stories of which are of Breche Violet marble, is the most recent example of this work. It is probably one of the most elaborate and costly fronts ever erected. Four stories are entirely marble, the variegated colors and high polish of which attract the attention of every passer-by. Without the protection afforded by the "Caffall Process' the brilliancy and polish would even now have faded, but an endurance is now secured for it equal to that of the polished granite base.

*Member of the Society. President, Obelisk Waterproofing Company. New York.

Management Engineering Applied to a Highway Contractors Work*

By Henry B. Drowne

THE fact that highway construction work looks simple and that only a relatively small amount of capital is required has led a large number of people to enter the field of highway contracting. Of this number some make a success, while others are a complete failure. Unfortunately, the law of the "survival of the fittest" does not always apply, because there are instances of those who survive through the medium of dishonest work Competition in this line of work is very close. The big contractor with large plant equipment and heavy overhead charges must meet the competition of the small contractor who has plant enough to work only one job at a time and probably personally superintend the work. There is another class of contractors who make competition particularly discouraging at times by ignorantly bidding work at figures all out of proportion to the actual cost. This last class, however, is rapidly eliminated after trying to do work for which the bids have been too low. On account of the above conditions a contractor, who operates on a larger scale, must have a sound system of management or otherwise he will be forced out of business.

The writer believes that any man or association of men who desire to enter the field of contracting should first incorporate, as there are several advantages gained thereby.

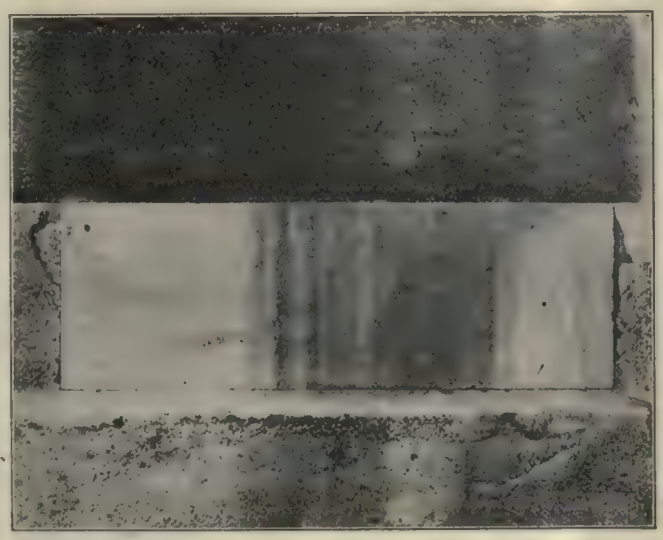
No attempt will be made to outline in detail the duties of the individual officers of the corporation. Suffice it to say that at this point there should be two main divisions of duties into what might be called office work and field work. The office work would include all financial transactions of the company, such as obtaining credit, purchasing bonds, insurance, machinery and supplies and all accounting incident to the performance of the business of the company. The field work would include securing contracts and the planning and supervision of all construction work. The work pertaining to the first division is of a most important character, and wise management and sound business in this department are in a large measure responsible for the company's success. On account of the brevity of this paper no further space will be devoted to this department. Consideration will be given to the management of the field work, that part of the work which is of more particular interest to engineers.

The generally recognized principles of good management are four in number and may be briefly stated as follows:

1. The equal division of responsibility between the management and the workmen.
2. The development of a science for each element of the work.
3. The selection, training, teaching and developing of the workmen.
4. The co-operation of the management with the workmen.

Usually the field work would be under the direct control of the general manager. A primary requisite to success is the ability to get contracts that will prove to be desirable work. It is difficult to make a poor job pay even under the best system of management, although an intelligent contractor will sometimes take one in order to keep his organization intact.

Second to securing desirable work would be the formation of the organization by means of which the construction work can be done. The building up of the field organization would be part of the duties of the general manager and its personnel is important. It is necessary to carry a permanent force that can be depended upon from year to year, this part of the organization comprising engineers, general superintendents, foremen, and skilled mechanics. The size of the permanent force would vary, depending upon the amount of work undertaken.



Part of the limestone base of the Obelisk. New stones put in place 1881 to fill gap; cement fillings and joints are in perfect preservation.

The general manager should personally or through his immediate assistants, engineers or general superintendents, keep in close touch with each contract under construction. When a contract was secured, the machinery and tools necessary to do the work would be shipped to the job. Careful planning will save money that would otherwise have to be spent for new plant, as it frequently happens that some special machine can be worked to advantage on several jobs in the same season. The purchase of all material and supplies of any large amount would be done by those in charge of the office work, subject to the direction of those in charge of the field work. A superintendent, together with foremen and skilled mechanics, would be selected to do the work and the approximate number of laborers necessary to start work would be determined upon. Questions arising relative to the interpretation of specifications, disputes with the party for whom the work is being done, estimating the amounts of work accomplished and the general planning of all the work would be attended to by either the general manager or his immediate assistants.

The superintendent is assigned to carry out the plans on a contract would be selected on account of his fitness to do that particular job. Each man has his limitations, and it is the knowledge of these limitations, that enables a successful manager to place a man where he will make good rather than to place him where he will be a failure. Besides being a man of energy and resource, a superintendent should be a man of good character. A contractor's reputation rests to a considerable extent in the hands of a superintendent and a reputable contractor values in a no small degree his reputation for doing honest and thorough work. The superintendent would be responsible for carrying out the work pursuant to the plans laid down by his superiors.

A good superintendent should always be cognizant of the cost of the work of each of his gangs and know whether the cost is out of proportion to the work that they are accomplishing. The gangs are never so large but that frequent inspection during the day and some mental calculation serves to show how work is progressing. Frequent visits by those in charge of field work would prevent slight errors on the part of the superintendent from becoming serious. Some companies require the superintendent to send to the office each night a daily report card showing the daily cost of doing the work. The writer believes that with a good class of superintendents who have the benefit of frequent conferences with those in charge of the field work the daily report card is not worth the trouble. The superintendent should, in any case, divide the work of the day under several classified heads which would be determined upon by those in charge. If a report of these classified costs for each day was sent into the office only weekly or even semi- monthly, it would prove to be efficient.

The fourth rule, that embodying the co-operation of the management and the workmen, is particularly important to all highway contractors' organizations. Construction work of this kind only lasts two-thirds of a year, yet it is remarkable how a reputable contractor will maintain his permanent organization from year to year, even though his men are beyond his control for four months. The management must make the men feel that good and faithful work is appreciated and be quick to show it. Even the common laborer should not be forgotten. Although a bonus or other system of increased wages is rarely used by a highway contractor in dealing with his common laborers, the latter should be shown that those who excel gain the reward.

* Presented before Section D of the American Association for the Advancement of Science at the Atlanta meeting, December, 1913.

How Engineers' Estimates Affect the Contractor

THE United States Government, the legislatures of all the states, the officers of every city, village and town, annually levy an appropriation to pay the expenses of running their respective governments for the succeeding year. Every railroad company and industrial corporation in like manner makes an estimate and appropriation for their corporate expenses. This must be done in order to keep the cost of operation and maintenance in reason and to limit the entire cost to a fixed sum of money which they anticipate receiving.

In like manner the engineer in preparing his estimate of the cost of any improvement should with care and deliberation go into all details and arrive finally at a sum which will be sufficient to pay the total cost of this improvement andall expenses connected therewith. This estimate should be ample and liberal to allow for all the requirements of construction and the contingencies which might arise.

There is occasionally an estimate for public work in the territory in which I have operated, that I would call reasonable; there are some that are fair ,more that are low—and some, very low. Engineers' estimates are invariably low. I have therefore taken for my text the following clause, found in every special assessment proceeding in the state of Illinois: "I hereby certify that, in *my* opinion, the above estimate *does not exceed* the probable cost of said improvement and the lawful expenses attending the same and connected therewith."

In that one word "my" lies the authority for the estimate, the value of the estimate, and whether or not it is adequate for the construction of an improvement. By that one word the state of Illinois has given its authority to an individual to carry out as constructions and to prepare an estimate for vast sums of money. It has not hampered him except as to the word "exceed" and, as everything is left to his personal opinion, the value of that word is negative.

At the first sight of this certificate, one would think that this estimate must be exactly what the proposed work would cost, and could not exceed that sum. That is what it is intended to be, but, with the fluctuations of labor and material, and other causes, estimates vary a great deal, and if not made with due care, by an engineer who has had a great deal of actual experience and who has kept cost accounts on construction work, will often prove insufficient.

The city engineer who does all his work in one city becomes familiar with all the conditions entering into the cost of work in that city, and usually makes conservative and reasonable estimates. On the other hand, if he uses the same schedule of prices of labor and material upon going to some other city or village, the estimate may vary either way, and if too low may cause the non-letting of the contract. Again, there are many instances where the engineer has made fair and liberal estimates, according to his judgment, but has been compelled to lower them on account of the opinions of some members of boards of local improvement, who consider the estimate too high for that particular locality. Low estimates often result in the failure to let the contract and the abandonment of the proceedings, the letting of the contract above the estimate necessitating a supplemental assessment, or the letting of the contract to undesirable contractors.

Less than a decade ago estimates of cost, both by engineer and contractor, were generally mere guesses. Both, however, are beginning to realize the value of keeping construction costs. Both in estimating and in carrying on construction, methods and costs are taken into consideration, so that a better understanding now exists as to the difficulties to be overcome in construction work.

Though every engineer and contractor has a different method of making estimates of costs, in the main and important details they are similar. For example, anyone estimating the cost of concrete per cubic yard can obtain prices from the dealers on the aggregate, sand, cement, steel and lumber. The exact amount of each material needed for a cubic yard can be calculated and set down without any guessing. There are only two items—the cost of mixing and placing and the cost of erecting and removing forms, both items of labor—that remain to be estimated. By consulting some practical concrete man who does this kind of work, or taking it from cost records, the estimator can ascertain the cost of these items. Adding to it allowances for plant and general expenses, the contractor's legitimate profit and discount of paper, he has a fairly accurate estimate. This method reduces guesses to a minimum, and instead of a guess in a lump sum, what little must be done is confined to a few items, generally a small per cent. of the whole. Those who follow this method and do much estimating will soon learn the various man and machine units of work per hour or per day, so that the only uncertain element of labor cost will be the flucutation of wages.

There are many conditions which affect the fluctuations of wages. Men may be plentiful when a job starts, but wages may increase, due to the beginning of other work in the same locality or generally good business conditions, and labor become difficult to obtain. In many cities, labor unions are in control of the situation and a union scale of prices is in effect and must be met. In many smaller villages and cities, no satisfactory floating supply of labor is to be obtained. The contractor must import laborers and provide a place to sleep and feed them, an added cost on small contracts. Wages paid to local labor are always higher for an outside contractor than the prevailing local scale, usually about a 25 per cent. increase.

Local laws may also affect the labor costs. City ordinances imposing regulations on maximum loads, etc., may increase the cost of the work. The engineer must look fully into the wages paid in any locality where work is to be done and also into the many conditions which might arise.

Look Out for the "Contingent Costs"

In the case of materials to be used, there should never be any guess work as to their cost. Before the estimate is compiled, prices of all the materials, based on the approximate amount needed, should be obtained in writing from the manufacturers or dealers. In the request for such prices, it should be stated what the materials are for, and about when and where they will be required.

Every contractor is familiar with the items of contingent cost encountered in nearly every specification He reads them over and says to himself, "Oh, that isn't much; that doesn't amount to anything." It does not, if there were only one; but, taken in the aggregate and put into dollars and cents, it represents a large item of cost. If he does not figure it, his profit is reduced; and the probable reason he has never figured it out is that he could not get his bid under the engineer's estimate if he had—for the very reason that the engineer had omitted it also. Here is the big question: "Do engineers ever figure the contingent cost and add it to their estimated cost?" I believe that here is the true reason why many estimates are too low.

The following items of contingent cost enter into nearly every contract:

1. Expense of looking over the proposed work, attending the letting and closing the contract, if successful.
2. Attorney's opinion as to legality of the special assessment proceedings and bond issue.
3. Cost of the surety bond.
4. Cost of maintenance bond.
5. Cost of liability insurance policy.
6. Moving outfit to and from the work.
7. Plant maintenance.
8. Tools lost, broken and stolen.
9. Wasted material.
10. Demurrage.
11. Losses due to weather conditions and damages of the elements.
12. Pay roll and expense of oufit in rainy weather.
13. Pay roll of superintendent and foreman for three months of the year, when not at work.
14. Local charges for use of water.
15. Broken drain or water pipes.
16. Unforeseen damages to walks and private property.
17. Cost of inspection of materials.
18. Stakes and help for the engineer.
19. Barriers and red lights.
20. Lost, torn or damaged cement bags.
21. Being a good fellow.

I could explain each of these items more fully, but the mere mention of them will suggest many instances to every contractor. Every one of these items enters into the cost of an improvement. Each is as much an item of cost as labor and material. Taken separately, they amount to but a small sum, but inthe aggregate they total from 10 to 15 per cent. of the cost of an improvement. How many engineers take cognizance of these items and include them in their estimate? Yet their specifications and contracts call for them.

No business can succeed without profits, and no contracting company can succeed, and stay in business, without them. This leads to the question, "What constitutes a fair net return on municipal work?"

The contractor's profit depends on the price he bids for the contract, and often varies for the same class of work. In early spring he may bid very low, to get his organization ready for the season, especially if he carried no work over from the preceding year. Later on he, perhaps, obtains contracts at legitimate prices, thus averaging up on the year's business.

On force account work, with every facility at hand to do work, the usual allowance for use of tools and profit is 15 per cent. Gillette figures profit on the basis of 10 per cent. on the cost of material and 33½ per cent. on the cost of labor. This would probably average about 20 per cent. on the whole contract.

Contractors for municipal work are paid in cash or bonds. The occasions when they are paid in actual currency are so

rare that they need not be discussed. These bonds are of two kinds: the municipal bond, guaranteed by the city or village as a whole; and the special assessment bond, issued by the city or village in anticipation of the collection of the tax upon each lot or parcel of land benefited by the proposed improvement. Here are two classes of bonds issued by the same city or village for the payment of the same class of work, each drawing 5 per cent. interest, each taken by the contractor at par, yet of very different market value.

The special assessment law of the State of Illinois is considered very much superior to the similar laws in Iowa, Wisconsin and Indiana, irrespective of the fact that where only 5 per cent. interest is paid in Illinois 6 per cent is paid in these other states. The special assessment bonds of these states readily sell for par, owing to the increased rate of return on the investment, and the public buys them for the reason of that particular attraction. The Illinois bonds assessed on relatively the same kinds of property are sold at a discount of from 5 to 10 cents on the dollar, in order to net an average of 6 per cent. or more for the time that they have to run.

Here, then, we see the property holders paying nominally 5 per cent. on an inflated cost of an improvement according to the state law, but paying 6 per cent. or more on the actual cost. This difference of cost of the work, ordinarily termed discount, must be added to the engineer's estimate as a part of the cost of an improvement. This discount is not always 5 per cent., but varies as the money market changes. When money is plentiful, bonds can be marketed at 95. but during the last year many have sold for less, if they could be sold at all.

Special assessments are levied against every lot or parcel of land benefited by the improvement, according to such benefits, and the assessment must be equitable. The amounts so assessed are spread irrespective of the value of the lot or the owner thereof. If the property assessed is improved, the value is greater and the security behind the bond is increased. If the property is vacant and poor in value, it has a tendency to decrease the security of the bond, unless it is so located that its improvement or the growth of adjoining property enhances its value.

Again, many assessments are spread against property which has been sold for taxes and been forfeited to the state. In this case, the state pays no special assessments. Hence, in looking over proposed improvements before the letting, the contractor usually examines the assessment and if he finds property forfeited to the state, it reduces the amount available for the construction of the improvement by the total amount of the forfeitures. If the estimate, after taking off the forfeitures, is too low to do the work, the contractor either must not bid at all or else must bid above the estimate. From these facts it follows that it should be the duty of the engineer to look over property before making his estimate, to ascertain its condition, and make his estimates accordingly.

Make Sure of Value of Bonds

The first duty of the contractor, when he receives bonds for work, is to see that they are good. He must depend upon the expert attorney to advise him. But such advice, however favorable, will not force a property holder to pay his tax for an improvement, nor will it force the state to pay a tax upon a lot which has been forfeited to the state for non-payment of taxes. No special assessment bond becomes forfeited if every lot or parcel of land pays its tax. If property that is assessed for special assessment improvements is clear as to title and is worth as much or more than the assessment, there is not much doubt of the assessment being paid. It is this doubt or possible chance of a forfeiture that bankers and bond-buyers shy away from. They use it as a club to force the contractor to sell his bonds at their price. After having the opinion of the expert and of their own legal talent as well, they send representatives to look over the property assessed, and if there is no possible chance of a loss, the contractor may be offered 95 per cent., if 30 per cent. of the property is vacant, 92 per cent. If there is a forfeited lot, he will get no offer at all.

I am going to suggest two remedies that I am positive, if made law, would have a good effect on the market value of these bonds. As they depend upon the engineer's estimate they may properly be included here.

First, the engineer's estimate should be ample; enough so that after paying the contract and the 6 per cent. allowed by law for the expenses of making the assessment court costs, etc., there would be left a residue. Our present law requires that after the cost of an improvement is determined, the residue shall be rebated to the property holders before they pay thir assessments. They pay only what is actually required. My suggestion is that no rebate shall be made until the final bond is paid. I contend that if the property owner elects to take five or ten years to pay his debt, he should pay all expenses connected with it. I contend that the contractor should not assume the collection nor stand the responsibility of the non-collection of special assessments. If there were a residue or reserve left in the special assessment fund, over and above the obligation or requirements of that assessment, it would undoubtedly go far as a guarantee toward insuring the full payment of every bond and the interest thereon, in case of a possible default in the payment of some installment.

Secondly, 6 per cent. is allowed by law to reimburse general fund accounts for cash advanced on account of the expenses of levying all assessments, and this 6 per cent. is always drawn from the first installment. Thereafter there is no fund to pay any expenses which may develop on account of the special assessment. If some of the property holders pay their assessment in full, the interest stops on their portion but the bonds continue to run until called. Here is a loss of interest and no fund to pay it. There might be a default on some payment of an assessment and no fund to pay it. The bonds are obligations of all the property holders, and inasmuch as the state has seen fit to assess them 6 per cent. for the making of an assessment, I can see no valid reason why another assessment of, say, 5 per cent. should not be levied and held as a sinking fund or reserve, to pay the loss of interest and forfeiture, if any, and at the final payment of the last bond to be rebated to the property holders.

The assessing and creation of this reserve will, in my opinion, bring the value of special assessment bonds to a higher plane as marketable and investment securities. Contractors who, in bidding heretofore have figured a return of 90 to 95 cents on the dollar, would, if these provisions were a law, be able to figure on the basis of nearly par. If the creation of this reserve acts as I think it will, I cannot see that the property holder eventually pays any more than he does at the present time. What he now pays for as discount will be offset by the increased value of the bond.

The present state law requires that interest shall be paid upon all of an assessment except improvements put in upon the one-year plan. There are a great many such improvements, so small in total amount as to dollars and cents that it is impossible to make them in 5 or 10 installments, where each installment must be a multiple of $100. Very often these improvements are put in in the early part of the season or late in the fall, and in either case, the contractor must wait a year or year and a half for his money without interest. I believe the laws should be amended so that this kind of paper would bear interest, putting it in the marketable class of securities.

There seems to be a dark cloud in our special assessment law in regard to interest on the first installment where there are deferred installments. The ordinance usually sets forth that all installments except the first shall draw interest at the rate of 5 per cent., yet all municipalities collect the interest on the first as well as on successive installments.

Some municipalities issue vouchers on the first installments which bear no interest, but more of them issue those bearing interest. The former apparently have the law with them; the latter do it because they think it fair and honest, believing that as long as they collect the interest on the installment they should in turn pay it out on the voucher or bond. The special assessment law should be so amended that all installments shall bear interest and that all vouchers issued against the first or succeeding installments shall draw interest.

Summing up, an engineer's estimate, to be fair, conservative and reasonable, must be based on the following:

1. The actual cost of material and labor.
2. Contingent costs, amounting to from 10 to 15 per cent. of the above.
3. Contractor's profit, amounting to from 10 to 30 per cent. of the first two items. This will vary according to whether the contract is hazardous and difficult, requiring a large amount of special equipment, or whether it is comparatively easy, requiring but little equipment.
4. Allowance for converting the bonds into cash, amounting to at least 10 per cent. of the total amount of the contract.

—*Engineering and Contracting.*

Bill of Extras

Some contractors take particular pleasure in bulking out their bill of extras. As a consequence it often contains items that have little chance of getting O. K.'d by the officials in charge. Mike Giffen was one contractor who believed in a fat account for extras. He was putting in a sewer system in a New Jersey city. Part of his outfit consisted of a mule called Old Sol. This animal was contrary; if you wanted her to back she went forward; if you tried to make her go ahead she backed. One day Mike came along the trench and found four men struggling with Old Sol. Three men had hold of her head, while a husky dago was belaboring her rear with a pick handle. "Here, here, boys," said Mike, "try a bit of kindness." The men let go and the mule stopped backing. Mike went up to her, scratched her head and patted her nose. Old Sol pivoted around on her front feet and landed a rear hoof on the third button of the contractor's vest; she then commenced to back and ended by falling into the 16-ft. trench. Mike, considerably shaken up, came to the opening and looked down. There lay the mule stuck fast 2 ft. above the sewer pipe in the bottom. Old Sol had kicked her last kick, for the fall had broken her neck. Mike looked up and down the trench; the inspector was nowhere in sight. "Fill her in," he said. When Giffen brought in his bill for extras, it contained one item that read: To 1 mule used for back fill.....$1.50

—*Engineering News.*

The Engineer and the Contractor—Their Relation on the Job

THE Engineer or Architect is able to plan great structures and large engineering schemes, but when it comes to the erection of these structures or the methods adopted in carrying out these engineering feats to successful conclusion, this work usually devolves upon the Contractor.

The Contractor occupies a peculiar position in that, to be successful, he has to be possessed of a temperament and faculties not required in the average profession; I mean that the successful Contractor meets and has to contend with, more obstacles in his work, than falls to the lot of the average business man or merchant, and in addition he has to be able to manage and direct his office affairs and the work of his employees in such a way that for every dollar spent on his work he hopes to receives more than one hundred cents in return.

The Engineer has a great many advantages in planning a great enterprise over that enjoyed by the Contractor; usually he is not limited in the time taken in drawing his plans and specifications, and has ample opportunity to investigate all conditions and make researches prior to the time when bids are called for, but the time usually allotted to the Contractor for preparation of this bid is usually very short, and often a sufficient period is not allowed him for investigation of conditions, etc., source of supply of labor and material, and other important considerations which go to make up the bids prior to the opening of the same.

It has been said, and truthfully so, that a successful Contractor must have three qualifications, first, Faith; second, Hope, and third, Nerve, and of these three virtues (if they may be so termed), it seems to me that latter is the most important.

First, Contractors as a general rule usually know the men at the head of all large engineering schemes, upon which they bid and have faith in their judgment, and accept without question their plans and specifications as being correct, and the result of months and probably years of study, and rely in a great measure upon their judgment.

Second, they hope in event of securing a contract, to be favored with such conditions when the work is under way, as will enable them to make money legitimately, because you will find that the average Contractor doing business today, is honest, and he takes a certain amount of pride in his work (although in this, as in all cases, there are exceptions to the general rule), and he hopes when certain conditions and questions arise, during the progress of the work, and the matter under discussion put up to the Chief Engineer or other official in authority, that he will be big and broad enough to look at the situation from the Contractor's standpoint, as well as from the viewpoint of the Municipality or Corporation by whom he is employed.

Third, to undertake large contract work, requires considerable nerve, because usually if conditions are favorable and the prices at which the contract has been secured are reasonable, and the specifications liberally construed by fairminded Engineers the Contractor sometimes makes money, but ofttimes when unforseen conditions arise during the progress of the work, materials and labor advance, extremely rigid and arbitrary interpretations are given to the specifications, impractical and unreasonable inspectors placed on the work, and various other obstructions put in the Contractor's way (sometimes by those directly interested in the contract, and at other times by disinterested parties), it requires considerable nerve on the part of any man to continue the business of contracting in order to make a living.

Practically all recent works of great magnitude have been let by contract, with one exception, that being the Panama Canal, which is being built by the Government, under the supervision of Army Engineers who had practically an unlimited amount of money at their disposal, and who were not hindered in any way in the expenditure thereof; their motto being, "Build the Canal, build it well, and at any cost."

Great works like the increased Water Supply for New York City, the New York Barge Canal, the reclaiming of millions of acres of land in the West ,the improvement of our rivers and harbors, and even down to our own local improvement, such as the water supply, the building of our Sewers, Paving of the Streets, covering of the Falls, building of the docks, extensions of Parks, improvement in terminal facilities of the various railroads leading into the city, the improvement of our State highway system, erection of municipal buildings, etc., have all been let by contract, for the reason no doubt, that those in authority recognize that where possible, it is much better to have the work done by this method than under the day labor system.

The work is done as well under the contract system as if it is performed by day's work, and ofttimes better, because on day labor work done by a State, municipality or corporation, usually there are no rigid specifications in effect and practially no inspections (except when the Engineer happens to be on the work) and many things are done, which would not be tolerated for a moment if the work was being done under contract; furthermore, the Engineer on contract work has less worry (this being shifted to the Contractor's shoulders), and the last, but not least reason is that it is almost universally conceded that work done by contract is done far cheaper than if performed by the day labor method.

A prominent Engineer once told me that "specifications were only made for rogues and thieves, that honest men did not need any specifications"; he meant this, however, to be interpreted in a broad way.

I do not fully agree with him in his statement, because I believe that short specifications clearly written and impartially enforced are a benefit to both the municipality or corporation and the Contractor.

The clauses in a set of specifications as written by the average Engineer are not always clear and intelligible to the average Contractor, and anyone who engages in contracting work now, if he wants to be "up to date" should take a course in law also, so as to be able to reason out the intent of some Engineers who write specifications, because some specifications of today if literally construed as written, could place an average Contractor in receivers' hands in a short time, unless he had an unlimited amount of money at his disposal.

Take the usual set of specifications as issued to-day for public work to reputable attorneys and ask them to give you an unbiased opinion of its contents and ninety-nine out of one hundred will tell you that you would be foolish to sign a contract with such clauses incorporated therein, because it is so written to provide all the safeguards possible for the municipality and to place the responsibility for everything that may happen, even including the Acts of Providence upon the Contractor.

In other words, they bind the Contractor hand, foot, body and soul, because some specifications have almost every possibility and condition between the heaven and earth, and even into the depths of the same covered by a clause which they can point out, which covers the disputed point when questions arise, but Contractors must live, and some in their eagerness to secure work would sign any contract and specifications no matter how indefinite or unreasonable it was.

To my way of thinking, it is a mistake to make specifications too lengthy, but some Engineers seem to think that it is absolutely necessary to have a large volume of directions written for Contractors' guidance, even though the job is a very small one, they write so much in fact, that their requirements overlap, that is the clauses contradict themselves, and in one part of the book you will find certain clauses, and by carefully reading subsequent paragraphs, you will be left in doubt as to the real intent and meaning of the one who wrote the specifications and as to how they will be enforced.

If the specifications were short and clear, that is, expressed in plain every day language, which neither the Engineer or the Contractor could take advantage of (in other words the avoidance of double meaning clauses), many of the disputes which now constantly arise would be prevented.

When a dispute does arise on work, the interpretation of the particular clause in question, is usually put up to the Engineer in charge of that particular section or piece work for decision, and this is where a young Engineer should be given some authority.

If enough confidence is placed in a man to select him as the pilot of a particular piece of work, enough trust and authority should be placed in him to construe disputed clauses liberally when the occassion arises, and he should be given the right to settle minor questions that arise, and not be troubling his Chief with every little matter of detail, and only in case that he and the Contractor cannot agree, should the question be carried to the Chief Engineer.

In ninety-nine cases out of one hundred minor disputes such as arise on contract work can be reasonably and promptly settled if all parties will meet with a feeling of friendliness and confidence, but the average young Engineer knowing that he has the book of specifications to rely upon, and that they are his doctrine and the further fact that he is in authority in so far as that particular piece of work is concerned, ofttimes looks at the clauses under discussion from a very narrow point of view, and if an appeal should be taken from his decision and carried to the Chief Engineer, ofttimes he considers it a personal reflection upon his professional ability, and although the decision of the Chief Engineer may sustain him, there is always a feeling of coolness between him and the Contractor.

Whereas on the other hand if the decision of the Chief Engineer should be adverse to the young Engineer and contrary to his views already reported to his Chief and in favor of the Contractor, usually he feels that a personal insult has been inflicted on him and his professional ability

questioned, and I have heard of instances where the Engineer resolved to "get even" and he holding the master key sometimes is in a position to take advantage of the other, because co-operation is the key to success in all great works.

Engineers and Contractors gain their experience from years of hard work; text books do not contain all the rudiments of any profession, these are secured by personal efforts, hard knocks and practical experience and a young Engineer at the completion of his required course in a university is not as fully qualified to pass on all questions, as one who has had years of experience, although the technical education of the latter may be somewhat limited when compared with that of the former.

Contractors usually get their experience by hard work, and ofttimes at great expense, and some reliance should be put in their judgment also; in other words, some little credit should be given a Contractor who has had years of experience, for knowing a little of the work he undertakes and the best method of conducting it, because, as before stated, a Contractor to be successful must adapt himself to all conditions; must have such a personality as will enable him to please and work with the Engineers and at the same time look out for himself from a financial point of view, if he is to be successful.

I feel that I have already taken up too much of your time for the discussion of this subject, there are many other points in connection with it that I would like to bring out: Let it be sufficient to say, however, that an Engineer should rely somewhat on the Contractor, "give him some credit for his experience, etc.," and the same confidence should be put by the Contractor in the Engineer, and if they are of such temperament, that they can work in harmony, disputes will not arise, and when they do, they can be quickly and amicably adjusted and leave no ill feeling at their conclusion and success will be the result of their efforts.—*Engineering News.*

More Time to Prepare Bids

Three small cities opened bids last week for public improvements. In each case the time from the first insertion of the official advertisement to the opening of proposals was only seven days. The works were comparatively small as construction undertakings go, yet they were of the utmost importance to the municipalities proposing them. They had been under discussion for many months, the necessary legislation had consumed much time, the preliminary arrangements had taken weeks, and yet when it came to the really important part—the placing of the work under contract—contractors were allowed but one week in which to prepare their bids. This of course cut down the competition. Contractors who had followed the proceedings closely were able to put in their figures. Others who would have been glad of the opportunity of submitting estimates on the work learned of it too late. Instances like these are of frequent occurrence. A small city or town will proceed with the utmost deliberation in getting ready for an improvement and then when the final decision to go ahead is reached there is a hurry up call for bids. Very often the official advertisement is inserted only in the local paper. When this happens the outside contractor, unless he has been notified by the engineer or municipal officials, usually secures his first information of the work from the news columns of the technical journals. It is then often too late for him to obtain the plans and specifications, visit the city, and make the necessary investigations preparatory to submitting a bid. The time element in a public works letting is of the utmost importance both to the municipality and to the prospective bidders. If plenty of time is allowed for the preparation of bids there will be increased competition and better prices will be obtained. Where the time limit is so short that contractors cannot investigate carefully and figure accurately they will either pass up the work or will put in bids high enough to protect themselves from all risks.

Waste in Bidding

Most of our economic waste is due to a lack of a definite knowledge of costs. For instance, in a building project where seven or eight contractors, all of the same general class are called in to submit proposals on the work, there will be a difference of 30 per cent. between the highest and lowest proposal—all of which means that costs in opinion:. shrduletaoincmfwypshrdluvbgkqj this industry are largely a matter of opinion.

With costs only as a matter of opinion, the building public has no confidence that one man's judgment represents the lowest market price, so a group of men are called in to spend their time and money in making an estimate, and with no reward—only the hope of reward. All this is wasted effort with them all, save the successful bidder.

Very few people realize what it costs to make estimates on bidding projects, even though the basis of an estimate is not a matter of definite knowledge. Take a court house or city hall, say one costing a million dollars, exclusive of the heating, plumbing and decorations. It will cost each general contractor who submits a proposal $1,000 in travelling expenses and the labor of estimators. Say there are eight contractors figuring on the work. This means that through a lack of confidence, which has been accumulated, which society, some-of definite knowledge, a debt of $8,000 has been accumulated, whic hsociety, somewhere, somehow, must pay.

With smaller building projects the cost of making estimates is very much higher in percentage, double in some cases, and when we consider all the estimating of all the building in a year, the amount expended in both money and effort, in order that the owner may know the lowest market price, is a gigantic total and a frightful economic waste.

It has only been within the last few years that there has been any organized effort among building contractors to determine absolutely costs in the detailed operations of building, and with the same certainty and accuracy that the typewriter, adding machine, automobile, and low-price watch manufacturers know their detailed costs. This organized effort for cost finding has only been with the very large contracting organizations, and is of little value because they have the unfair competition of those who do not know their costs.

The average contractor in the average city has no definite knowledge of the cost of a cubic foot of brick work, a square of floor, a yard of plastering or the average cost of putting on inside trim, fitting such and hanging doors. The average knowledge of building costs is inherited—the present generation got their present basis of prices from their fathers or their former employers under whom they learned their trade. These prices have been increased in percentages from time to time as material and labor prices have increased, but no doubt the original basis of them was wrong.

The average contractor's bookkeeping, together with his cost keeping, is so indefinite that he does not know until a contract is completed or until the end of the year, or until he goes out of business, or dies, whether he has made any money or not. He may make money on one operation and lose it on another, or on one contract and lose it on another; he gets too much for one operation or one contract and not enough for another.

Then comes the moral effect of a lack of definite knowledge of costs. The shrewd owner finds that costs are a matter of opinion, and he at once undertakes to change that opinion by applying horse-buyer methods in order to get his building as cheap as possible; the contractor in turn takes this as a moral license to "trim" the owner at every point, even to the extent of slighting the work. The owner comes back with bonds, forfeitures and iron-clad contracts, all of which are childish, for no one can make a man do good work if he hasn't the free will with a profit as an incentive to good work. The building contractor has not made money in the same sense as other industries involving the same skill, responsibility and capital.

The solution of this evil is in very simple local organizations of contractors, not to control prices, but for the purpose of educating each other to costs. Price will take care of itself naturally if each knows his cost; for it isn't natural for a man to sell less than cost if he knows it. It is just the difference between knowledge and ignorance, efficiency and obstruction.—*Contract Record.*

Liability for Extra Cost

The American Contractor received from a Chicago architect the following communication:

About two years ago I made some plans for a three-story building on Halsted street. The plans were approved by the building and sanitary departments at that time, but work on the building did not begin until about a year later. Then we received a notice from the building department that the fire walls above roof should be 12 inches thick and 3 feet high, instead of 9 inches thick and 16 inches high, which was and had been the practice all over the city, the plans being approved with the latter dimensions. Now the city is suing to have the fire wall changed as indicated above. Who is responsible for the extra cost in making the above changes, the owner, general contractor, mason or architect?

Submitting the question to a legal firm, which has had extensive practice in this line, this is the reply:

In my opinion the contractor or the mason are not involved in the question of liability. Whether the owners or the architect have to bear the liability depends upon their dealings with each other. In the question the architect says, "Then we received a notice, etc." If he meais by that that he and the owners received a notice or both knew of it and then went ahead regardless, in my opinion the owners would have to bear the cost of the changes. But if the notice was known to the architect alone and he did not inform the owners of the same, he would be responsible. It makes no difference that the first plans were approved by the building department, for there was a long delay after the permit was taken out and the starting of the building. In the meantime the requirements of the department may have been changed and there should have been a strict compliance with said requirements. I say then that if the owners knew of the notice to change the specifications and did not have them so changed, then they are liable. But the architect is liable, if in any way he kept the notice a secret, or did not fully inform the owners of all the facts in connection with it.

Engineering Law

By Wm. L. Bowman
Attorney-at-Law, New York

Cost in percentage contracts

Percentage contracts are undoubtedly increasing in favor with owners, especially where they contain a fixed limit of liability for them. Much of their mystery to the owners has been changed by the legal decisions involving this form of contract so that to-day the mere fact that the architect may protest against it and the contractor may beg for it, does not always result as formerly in letting the architect have his way. The decisions and some of them very late, hold that where a building contract imposes upon the contractor the ordinary obligations of furnishing all the materials and doing all the work required therein and of being responsible for the obligations incident to the erection of a building, the rules of law applicable thereto are the same whether the compensation is fixed by a lump sum or by a defined cost and a specified percentage thereon. The fear that if this form of contract were used the contractor might be held to be a servant and hence make the owner liable for the damages resulting from accidents was often found to cause an owner to decide against the percentage contract. Now that this trouble is removed, the two important matters for consideration are the "cost" and the "percentage."

What do we mean by "cost"? Let us turn to some legal decisions for the answer. Although it would hardly seem necessary there are cases which have raised and settled the fact that "cost" does not and cannot include "profit" of the contractor himself although it may include "profit" of a subcontractor. This matter of subcontracting will be taken up later as it is especially interesting in the consideration of the percentage actually paid. Probably the most familiar and best known form of percentage contract is that under which the architect commonly works. He is paid a certain percentage on the "actual cost." This has been judicially declared to mean the total cost of completed buildings including permanent appliances and fixtures. In another case it was held not to include damages given in a law-suit to the contractors for delay caused by the owner even though the damages were measured by extra expense in the construction caused by increase in cost of materials and in the cost of labor. The author has just completed a case of such interest involving this matter that some of the facts will be given.

The owner contracted to pay the architect a certain percentage on the "cost of the contracts." That was understood by the owner to mean on the "cost of the building." When the work was within three weeks of completion under a $7,500 contract, the owner having money troubles failed to make a payment due the contractor. The latter having a losing contract immediately claimed a breach of contract by the owner and declared his option of stopping the work and thus requiring the owner to pay for the work actually done at its reasonable value. To get his building and prevent a lawsuit the owner agreed to pay all unpaid material bills, the labor cost for the future and a certain weekly wage to the contractor to act as superintendent in the completion. In this way the building actually cost the owner $9,000. The owner thought he had a grievance against the architect so he then refused to pay him a balance due him when the architect presented his bill based upon $7,500. Action was then commenced after a mechanic's lien was filed and after a trial the judge rendered a decision granting the architect compensation based upon the actual cost of $9,000. This gives us one principle that cost means the full money price without consideration of the reasons for the amount.

There is a case which holds that "cost" does not include materials owned by the owner at least where part of them were incorporated in the work before the contract was made. By the schedule of the American Institute of Architects this matter is taken care of in the definition of "total cost" which is the phrase they use, and they state: "The total cost is to be interpreted as the cost of all materials and labor necessary to complete the work plus contractor's profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered." These cases show us that the owner must provide in the contract for materials or labor which he furnishes so as to be sure that he does not have to pay the percentage on their value.

Even the municipal cases help us in this matter. In one case where the city charter required the owners to defray the cost of sidewalks, it was held that where the payment was by bonds and there was a loss due to the poor credit of the city, such loss did not constitute a part of the cost chargeable. In another municipal case where there was no contract but where it was held equitable to pay the contractor for his work, the court decided that he was entitled to the actual cost of services and furnishing materials including all expenses, but excluding any profits and with interest on the total at the legal rate. This, by the way, was held to be the reasonable value of the work. It is interesting to note how popular percentage payments for extra or additional work are in municipal contracts. The basis of the percentage in one form of contract for a very large city is expressed "the actual and necessary net cost in money where new material is used and in addition 10 per cent. of such net cost for the use of tools and plant, superintendence and all other expenses incidental to the work."

Our considerations show that it must not be assumed as many do, that cost merely includes the money spent at or near the construction work for foremen, mechanics, laborers and for materials actually incorporated in the construction of the building. As a matter of fact "cost" includes all these and in addition such items as rental and depreciation of mechanical and other plant, utensils and tools; expenses of bonds, fire insurance and employer's liability; administrative expenses of the main office; overhead charges for engineering, clerical, etc., work; interest on investment or rent of main office and equipment with the incidental expenses, etc. Hence the only safeguard for all concerned in this form of contract is to have the "cost" carefully and fully defined with a statement that all other disbursements or expenses of any nature whatsoever shall be borne by the contractor and considered as included in the percentage paid him upon the "cost" defined.

We are now ready for the interesting discussion as to what percentage is fair. A short time ago the author was asked by an engineering expert whether he could safely testify that 20 per cent. was a reasonable percentage to charge on a very large job. When asked what the basis of his cost was, the reply was the usual cost at the job. The cases then answered the expert and showed that courts had held in cases involving subcontracting that 21 per cent. was common and one instance was found where over 50 per cent. was allowed and held to be reasonable. All of these percentages result from the fact that subcontracting was permitted since the law allows a contractor to charge a reasonable profit on his sublet work or in a percentage contract to charge his percentage on the subcontractor's charge to him. This requires that an owner protect himself by restricting the subcontracting to certain classes of work where the law requires it to be done by a licensed man, such as plumbing, or where it is known that subcontracting will actually cheapen the work. The option of granting permission to sublet should be placed in the hands of the architect or engineer or else retained by the owner. With this caution he need never fear this matter.

It is admitted by large corporations that their overhead charges and expenses usually run from 2 per cent. to even 20 per cent. with an average of probably 5 per cent. This being so it is clear that no such corporation is going to get very rich on 10 per cent. contracts and that as a matter of fact such percentage is very reasonable. This also shows that based upon the popular conception of the owner that the 10 per cent. is all profit, the contractor should receive at least 15 per cent. on the usual basis of cost to get what the owner believes he is getting.

There is at least one of the States which recognized the fact that cost plus 10 per cent. was not profitable since it passed a law over fifty years ago whereby certain municipalities could charge an owner who failed to grade and pave his sidewalks the cost plus 20 per cent. From the owner's standpoint this was probably recognized as a penalty on account of the popular conception of the way municipalities often carry on such work.

Finally it will be noted that the small contractor who has no expensive suite of main offices and large, well paid staff of executives, engineers, etc., can afford to do work for a much smaller percentage than a contractor with such expenses. Provided the basis of cost is the same then the question to consider is whether the actual cost of the large contractor with his usually superior plant and organization will be sufficient-

ly lower to pay him a higher percentage. Further by defining the cost as it is usually considered, namely, solely at the job, there is as much opportunity for competition in the percentage form as exists to-day in the lump sum form. In this way also the owner may even get his building at less than the actual total cost to the contractor and yet there will hardly ever be sufficient loss to the contractor to cause him to cheapen and even abandoning the work as is now so common under the so-called uniform contract. The opportunities for quarrels between the architect or engineer and the contractors which necessarily involve the owner are almost eliminated. The causes for skinning and robbing the construction are removed. What more can an owner ask for provided the contractor shows an inclination to be honest, the architect conscientious and with the matters considered herein carefully covered by the contract clauses?

Accounting Department

Conducted by Harry M. Smith
Certified Public Accountant.

A prominent accountant, Mr. A. Lowes Dickinson, remarks as follows with reference to The Balance Sheet:

The objective of a set of books kept on sound principles and with accuracy is to enable the actual financial condition to be ascertained at any time. This condition is evidenced by the values of both property owned and debts due, which are together generally described as assets; the actual or estimated value of all liabilities; the surplus of one over the other, which represents the net worth or value; and a summary of the operations by which this net worth has been either created, increased or diminished.

Balance Sheet an Approximation.

It is generally claimed that a balance sheet must represent facts, but in the strict sense this is not altogether possible in any case that can be imagined.

If an individual possessing a certain definite amount of cash embarks this cash in various ventures which are all in due course liquidated, with the result that at the close of all his operations he finds himself with another definite amount of cash either greater or less than that with which he started, then he knows exactly what his profit or loss has been during the intervening period. But such a condition is an almost impossible one in practice except as applied to individual transactions.

A contractor may embark on a large piece of construction work, purchasing with cash all materials and supplies required; carry through his contract and at the close sell off all the residue for cash; he then knows exactly what his position is as regards this one contract. In practice, however, before one contract is completed, another is begun and plant and material used for the first are not sold but are transferred to the second, so that his activities form a continuous series of overlapping operations which may never come to an end or at any rate not for a long period of years. In the meantime he desired from time to time to ascertain as far as he can what his position is and how his contracts are working out, and he must for this purpose endeavor to put some value upon all his assets and probably estimate most of his liabilities.

Consequently, it follows that a balance sheet can only be an approximation to facts, the degree of approximation depending upon the skill and accuracy with which the estimates are made. The first step necessary to such an appropriation is the summary of debits and credits taken from the books of account, generally known as a trial balance. The trial balance is the work of the bookkeeper, while the conversion of this trial balance into a substantially accurate financial estimate of position, or balance sheet, is the work of the accountant. Assuming that such balance sheets have been prepared at different periods, each showing as at the date on which it was prepared the net worth of the individual or group concerned, then a comparison of the difference between the total of the assets and the total of the liabilities at any two separate dates shows the progress made during the period either upwards or downwards. The figure, however, by itself does not tell the story of the intervening period but merely shows the relative conditions at its beginning and end.

Causes Affecting Net Worth.

The change shown in the net worth may be due to any or all of the following causes:

(1) Appreciation or depreciation in the estimated values of the property or assets not in any way due to the activities or expenditures of the individual or group concerned, such as changes in value of land due to greater or less demand, or to discoveries of minerals; and in values of buildings, machinery or commodities due to a rise or fall in prices of labor and material since they were acquired.

(2) Capital brought into or drawn out of the business during the period.

(3) Gifts of property of any kind by or to the concern, not in any way connected with its business activities.

(4) Loss or gain arising from the excess or deficiency or ordinary expenditures made on trading or manufacturing as compared with the income from the sale of products.

(5) Loss or gain arising from excess or deficiency of ordinary expenditures on personal matters as compared with income from personal sources, such as interest on stocks or bonds, or rents.

In any complete system of bookkeeping the changes due to these various causes will be clearly shown by a careful examination of the accounts kept, the last two groups being those most difficult of ascertainment in full detail.

Balance Sheet Accounts.

In a general ledger, such as has already been outlined, an account would be kept for each generic group of assets and liabilities, and a balance account generally known as the "Profit and Loss Account" or the "Surplus Account" would include all other items. This account would be supported by such subsidiary accounts as might be necessary, either kept in the same ledger and closed periodically into the Profit and Loss Account, or kept in a subsidiary ledger or ledgers controlled by the Profit and Loss Account.

Form of Balance Sheet.

The following may be given as a specimen of a balance sheet designed to show the financial position in considerable detail and yet in a simple and understandable form:

ASSETS:

- Fixed Property (after deduction of estimated depreciation due to use):
  - Land and improvements thereon, including mineral rights and development thereof, but not structures of any kind.
  - Buildings and structures.
  - Plant, machinery, fixed tools, permanent way for railroad, etc.
  - Movable equipment.
  - Furniture and fixtures.
  - Patterns, drawings, dies, etc.
  - Patents, good will, franchises, etc.
  - Permanent Investments in stocks, bonds, or obligations of any kind held to produce income or other increment, or for purposes connected with the business (if any) carried on, including advances made for similar purposes but excluding investment of reserves.
- Investment of Reserves.
- Working Assets:
  - Stores and supplies for use in operations.
  - Advances to agents for business expenses and purposes.
  - Insurance, interest, taxes, royalties, etc., paid in advance of the period over which they accrue.
- Current Assets:
  - Materials carried for sale or conversion and products partly or wholly manufactured intended for sale.
  - Accounts and bills due from outside parties for goods supplied or short term advances made, and recoverable in cash, or its equivalent in some other class of current assets.
  - Investment in securities of any kind held as a temporary employment of surplus cash.
  - Cash at banks on deposit and current account, and cash on hand.
- Suspense Debits:
  - Consisting of discount on bonds, expenses of organization or other extraordinary losses or expenses which it is desired to write off to Income account over a period of years.

LIABILITIES:

- On Capital Account:
  - Partners' capital (in a private business).
  - Capital Stock (in a corporation).
  - Loans secured by mortgage or otherwise and running for terms of years, otherwise known as "Funded Debt."
- On Unfunded Debt:
  - For capital, as distinct from current purposes.
- Current Liabilities:
  - On current bank loans and commercial paper:

Secured.
Unsecured.
On trade bills payable.
On trade accounts payable.
On miscellaneous accounts payable.
Accrued interest, taxes and other periodical payments.
Provision for losses actually incurred, the amount of which is not definitely ascertained.
Provision for contingencies likely to arise out of past operations.

Suspense Credits:
Consisting of items which will eventually become credits to Income or Surplus but cannot be at present adjusted.

Surplus:
Appropriated to meet future contingencies which have not yet arisen.
Appropriated for repayment of debt (by sinking fund or otherwise).
Appropriated for capital expenditures.
Appropriated to equalize dividends.
Profit and Loss Account—being undistributed or unappropriated balance of profits (or losses).

CONTRACTING ON A PERCENTAGE BASIS—MANY SIDES OF AN IMPORTANT QUESTION—THIS PLAN MORE FREQUENT IN THE WEST

THE percentage plan of handling contracts has been adopted recently by a number of prominent contracting firms in Western Canada. This plan is one which in many ways suits some departments of the business much better than does the older "lump sum" method. It is a recognized fact that one of the greatest difficulties and drawbacks of the contracting business is the difficulty of reaching a satisfactory basis of relationship between the contractor and the owner. Under the ordinary method of contracting, the interests of thetwo parties, it will be readily seen, are often diametrically opposed.

Once the contractor has secured a contract, it is decidedly to his interests to rush the job to completion as quickly and as cheaply as possible. Quickness is quite essential as it tends to an early completion, an early settlement, the opportunity to use his gear and equipment in connection with other work and the closing up and getting from off his hands the necessity of supervision of the work. But cheapness is still more essential than is despatch in the carrying out of the work. It is here that the interests of the contractor and his employer are opposed. Every dollar that the contractor spends comes directly out of his own pocket. The temptation is always present to curtail expenditures with the probability that the owner's interests will suffer if this is done. Philanthropy and the contracting business are very far apart. The principle that the better the class of work and the materials used the lower the contractor's profits is not a principle that may be said to be conducive to the best results and the highest quality of work.

The Usual Percentage Method

When the subject of contracting on a percentage basis is alluded to it is usually associated with some such rate as ten per cent. This rate might be said, however, to be higher than the average; many large and important jobs are being carried out in the West at the present time at rates ranging from six per cent. to ten per cent., the latter rate being the highest paid and the average being perhaps eight per cent. The fixing of the rate depends entirely, of course, upon conditions under which the contract is to be carried out. It is in this connection that the one opportunity is provided for competition among the contractors, the lowest rate bidden having, of course, the first chance at securing the contract. It is in the bidding that the contractor has an opportunity to make a loss by bidding too low a rate, although the consequences are not apt to be nearly so serious as in the case of bidding on the job by the lump sum plan. He must figure upon all the conditions specified, what he will be obliged to supply in the way of gear and equipment, how great the wear and tear will be upon that gear and other matters of a similar nature, all in addition to the regular and usual matters which come up for consideration in connection with the bidding on a contract, many circumstances have a bearing upon the making of this rate. It is possible that the owner may provide a hoist or some of the other important parts of the outfit required. The question of the providing of the lumber for the forms in a concrete building is always an element—these and similar circumstances have a bearing in the deciding of the rate. The lower the rate, the less the contractor can afford to supply. When the rate is as high as ten per cent. it is safe to assume that the contractor is supplying everything in the way of gear and equipment as well as the materials and supplies necessary to the actual carrying on of the work. In cases in which the rate goes as low as five per cent., the contractor will probably supply very little in the way of plant and might be said to be merely acting as a building superintendent with the additional responsibility for the successful outcome of the work.

The rate is figured on the total cost, an estimate of which is prepared by the architect. If the total cost exceeds this estimate, the contractor is allowed his percentage at the same rate specified in the original agreement. In case he is able to complete the job at a less figure than that specified by the architect, he is a material gainer, as he is allowed a good percentage on the amount saved. The rate of the allowance on the amount thus saved ranges from twenty-five to fifty per cent. The greater the rate provided to cover such a saving, the greater the incentive to the contractor to save and while doing so he is saving for both himself and the owner.

It is this principle of dividing the savings which is one of the most attractive features to the man who has the true principles of business in mind. It will readily be seen that there is every incentive for the owner and the contractor to work together, how the contractor, while working for himself, is helping the interests of the owner and how both benefit by his efforts. The better the building and the higher the class of workmanship, the greater the returns to the contractor. Both parties gain by the extra expenditure, a more equable arrangement than under the older and more widely used system by which the better the building the less the profit of the contractor.

Advantages to Both Sides

The percentage system is a safer one for the contractor than is the lump sum system. There is little or none of the risk of making a mistake and taking a job at too low a figure. He has none of the responsibility for the total cost of the work, which, under the ordinary plan, is the greatest element of risk in connection with the business. His entire risk consists in the possibility that he may figure his rate too low—a risk that is a small one in comparison with the danger in other plans of taking jobs. Should he happen to make this mistake his loss will not be nearly so serious a matter than if the entire responsibility were his.

The percentage plan is one of many advantages to the owner. He has a greater knowledge of operations and a much more direct control of the work. He is able to specify any change or extra outlay without the necessity of dickering with the contractor. He may also effect a considerable saving if he so desires—by paying the bills in such a manner that he will save his cash discounts. He has a greater knowledge of both the quality and costs of the materials used. At the same time he has the advantage of having the work carried out and supervised by a contractor of experience who can use his knowledge and ability as well as his trade connection to further operations knowing that the better the quality of his work ,the greater will be his financial return.

Compared with Other Plans

Many comparisons have been made and much discussion has taken place regarding the subject of the first form of cotnract The solving of this problem is a difficult one. Each plan has adherents and vigorous ones. To the contractor who feels that his executive ability is such that he will speculate on it and that he must have such an opportunity to realize on it, the ordinary method presents the greatest opportunity. It is often the case that contractor—particularly in Western Canada—will spend thousands of dollars in plant and equipment in order that they will be able to carry on their work at the lowest possible cost and so that they will then be in a position to carry out a job at a lower figure than is generally recognized as the average cost. To those who thus wish to match their organization against the conditions and circumstances in connection with a contract, the lump sum will be the favored plan. To the firm or individual who wishes to follow a more conservative policy and to eliminate as far as possible any chance of loss the percentage plan will appeal most strongly. The latter plan has features which recommend it in case of a job consisting of alterations or repairs—in connection with jobs of this nature there are so many opportunities for mistakes in figuring a bid as well as for disputes and differences of opinion. For the contractor who is starting business in a new country where he may be more or less unfamiliar with conditions, the percentage plan will have much to recommend it.

The "cost-plus-a-fixed-sum" method of awarding contracts has many adherents among contractors. It would seem as if this plan would place the contractor simply on the footing of one who works for a fee. It is scarcely in human nature for the average man to take the same interest in his work as he would under one of the other plans mentioned in this article. When chance and risk and the prospect of a greater or less return is eliminated, it is safe to say that the average contractor will take a less active interest in the work. True, the contractor of integrity will give conscientious service under any circumstances but he lacks incentive ;he is not an active partner in the work but practically a wage-earner.

From the Western Canada Contractor

The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, OCTOBER, 1914 Number 10

PROSPECTS FOR CONTRACTORS

WHENEVER normal conditions are upset by a disturbance of some kind resulting in financial and business depression, contractors are among the first to suffer and, very likely, among the last to feel the effects of the recovery.

¶ It is at such times that contractors must depend on municipal improvements for work to keep them busy.

¶ Immediately upon the assumption of hostilities in Europe, business and commitments were curtailed to an unusual extent and new contract work which for several months previously had been very dull, was further restricted. Therefore contractors were feeling particularly discouraged.

¶ This being the outlook, an investigation made by "Engineering and Contracting" should be especially encouraging to contractors. That publication inquired from a number of city officials as to the prospects for municipal improvements in the year to come. From one hundred and fifty cities whose Mayors answered the inquiry relative to possible curtailment of city improvements, the following results were reported:

3% are expecting that construction work will be decreased, but solely because of local conditions.

19% are having or expect to have difficulty in disposing of improvement bonds.

63% think that European conditions will have no effect upon municipal work.

5% have already financed all work proposed for the coming year.

10% expect to do even more work than usual.

¶ Taken only at their face value these figures are highly encouraging. We believe that a premium may safely be placed on their face value.

¶ There are very good reasons why the average city should put forth extra efforts at this time to finance the construction of public works. The reasons are:

1. Favorable market for city bonds.
2. Competition among the best class of Contractors.
3. Cheaper materials.

¶ As regards the sale of city bonds, investors always turn to them as one of the safest forms of investment whenever business is upset, and they are doing so much more now that the stock exchanges of the world are closed. The stimulation in investments during October and November will be even more pronounced because of those conditions, and municipalities should take full advantage of the time before the usual December interruption.

¶ There is a financial stringency in business because banks have generally restricted credits, but this stringency does not affect the investing public very materially. The eagerness with which people have subscribed for the recent issue of the New York City bonds, and similar issues in a score of other cities indicates clearly that there is a good market for this class of securities.

¶ The best and cheapest work is obtained when it results from keen competition among the best class of contractors. Never before have we seen so many of the best firms in the country compete for public construction work which, heretofore, was quite outside of their line of work. As an instance of this may be recorded the three million dollar sewer contract recently awarded by the City of St. Louis to one of the largest railroad contractors in the country. Owing to their superior resources firms of this kind are able to undertake very large municipal contracts, and since much of the work is sub-let the smaller contractors also benefit.

¶ By taking advantage of this favorable combination of conditions, municipalities will not only get their work done better and for less money than otherwise, but they will also help immensely to restore individual confidence because of their unabated vigor in prosecuting their normal activities.

¶ In this connection, the newspapers have a duty to fulfill. In the rush to publish more or less authentic war news, their columns have been so filled therewith that domestic matters of greater relative importance have received scant or no consideration.

¶ We hope that they will soon show some signs of recovering from a too sordid desire for increased sales through hysterical head lines. Among the questions that deserve the consideration of our papers and magazines, none is more important than to urge the prosecution of municipal improvements.

Interesting Foundation Work

VERY often Contractors are under the necessity of beginning construction work with inadequate equipment, either because the difficulties to be met with are not definitely known or because they have not the necessary organization. In such cases their ingenuity is exercised toward providing the required tools from the materials readily available.

Waterfront before the fill was made. Otsego Lake, Cooperstown, N. Y.

The ability to meet unforeseen conditions and emergencies is expected of an experienced contractor, but it is not often that the owner himself has to devise ways and means to do his own construction work. The installation which forms the subject of this article is particularly interesting in showing what can be done with ordinary appliances. The ingenious methods adopted in this installation will, no doubt, prove interesting.

Mr. Amos Bissell, of Newark, N. J., bought from the State of New York a piece of land under water at Otsego Lake, Cooperstown, N. Y., and in the Letters Patent received permission to erect a dwelling and bath houses on the property. In the Spring of 1915 Mr. Bissell will build a summer home on the foundation which has already been constructed.

Mr. Bissell stated that his object in putting the fill into the water was because he "knew of no finer front door yard than Otsego Lake proper." The fill is wholly artificial, it was necessary therefore to provide suitable permanent foundations. The owner had for equipment a 30x5 ft. scow and a 50x12 ft. barge with a three-ton derrick. The barge was made of two 4½x4x50 pontoons which were tied together by 4x4 chestnut let in and spaced 3 ft. centers and cross braced. Over this was laid and tied 2 in. hemlock

Across the road behind the fill there was a bank of shale rock which was blasted and then carried to the fill on wheelbarrows. A fill 7 feet wide was started at right angle to the shore and went into the lake a distance of 80 feet, then turned and went northeast for 80 feet and finally swung around in an oblique angle. The object of this narrow fill was to protect the proposed piers from waves and to secure a proper location for bearings.

Twenty-four gauge steel tubes were made from 8 feet to 11 feet long without any brazing or reinforcements. The tubes were simply riveted together and cost about $4.50 each. The bottom of the lake is shale rock covered with about 6 in. to 12 in. of silt and clay, and the depth varies from 5 feet to 9 feet in that location. Bearings were taken from the line of the shore and a steel tube was sunk into the mud until rock was reached. With a four-inch hand pump the silt was then removed from the bottom of the pipe before the concrete was poured in. As the bottom sloped the tube would not stand straight. This caused considerable annoyance.

To overcome this, a tremie pipe of galvanized iron, 9 feet long, 6 in. in diameter at the top and 7 in. in diameter at the bottom, was made. On the top was riveted and soldered a 2x2 ft. funnel in which was riveted a ⅜x½ in. steel loop for the purpose of hanging it from the derrick. The loop being on the inside was troublesome when clearing the concrete when the tube was filled. It would have been an improvement to have had the loop attached on the outside, thereby keeping the inside of the pipe perfectly clear and smooth. Another improvement would have been to make the pipe 7 in. in diameter at the smallest end instead of 6 in. The procedure was as follows:

An 8 in. cup of steel with 3 in. perpendicular sides, was put over the bottom end of the tube. This was wired with ears riveted on the top of the pipe, using four wires for the purpose. The tube was then hung from the derrick hook and partly filled with a 1-2-4 mixture of concrete, which was mixed rather wet so that it would flow. As the tube filled it was lowered into the water, the concrete being kept at a higher level than the water. When the bottom was reached the funnel was filled, the wires cut and with a quick jerk part of the contents of the tube deposited on the bottom. Great care was taken not to lose the charge. The position of the tube was moved after each jerk so as to keep the concrete as near level as possible and as soon as the water started to rise in the steel form,

Completed fill. Note the concrete piers.

showing that the bottom was well sealed, the concrete was allowed to set about twenty minutes. The form was then pulled perpendicular, and as soon as it would stay plumb, the tremie pipe was removed and 4½ in. steel bars were inserted and hooped. At the end of a week's time the water was pumped completely out of the form and the laborers could then shovel in the concrete faster than the water could flow through the small cracks and cause annoyance.

On some of the piers the tremie pipe was left in position and at the end of twenty minutes, after the concrete had settled well, pulled it plumb, inserted the rods and continued filling until they had it as high as the water. In the top of these piers was inserted a 1¼x18 in. steel bolt with a nut, allowing 8 in. of this nut to protrude. Some sharp pieces of twisted steel were put in about this bolt and some smaller pieces were also inserted perpendicularly to share the strain in case the bolts had to be used for their designed purpose. This precaution was necessary because a strike of the Italian workmen was feared, in which case it would have been impossible to put the rock fill around the piers to support them and in heavy weather or in the ice they might be shifted or thrown out of position, and whatever bond they had on the bottom or bed rock would be broken. In case the fill could not be made around them it was intended to take large bars, have an eye bent in the end and use them for slipping over the bolts and in this manner firmly tie all the piers together to save them.

As soon as the rock fill was completed around the piers, forms were made to put up batter boards and square cobble tops wherever the piers would show and solid concrete on the inside piers. The forms were removed the next day and the cement removed from the faces of the stones and the whole thing was immediately covered with leaves and building paper weighted down, Not one of the piers is out of line at the present time and not a stone is loose. It is now just one year since the rock fill was completed.

The gravel used was native gravel in which was mixed a course of sharp sand. Two men would tow the barge with a four H. P. 2-cylinder launch 1½ miles up the lake and in the morning, fill it with gravel, approximately 15 to 20 loads, and would tow it to the fill in the afternoon and the mixing board would be pulled out of the water on to the barge, cement wheeled out from the storehouse and a barge load would be used up in the foundation work. It took six days' actual work for four men to put in the 25 piers. The fireplace rests on five piers.

Constructing the concrete piers with aid of tremie pipe. Note manner in which concrete was mixed also derrick mounted on barge.

Report of the Special Meeting

The Special Meeting of the Society, held in the Society Rooms at Eleven Broadway, New York, on Thursday, September seventeenth, at eight o'clock, was attended by enthusiastic and interested members.

Mr. William Law Bowman, C.E., Attorney-at-Law and Director of the Society and well known for the valuable and excellent articles he has contributed for publication in the Society Journal, in connection with the Engineering Law Department and the work of the Committee on Legislation, delivered a paper entitled, "Legal Hints for Contractors."

Many important points in Contract and Specification phraseology were taken up and carefully explained as construed by the Courts. The definition of such terms as "Extras," "Additional Work," etc., were made clear and many questions asked the speaker were generously and splendidly taken up and dissected by him and invariably the matter was explained by the recitation of some similar example in his experience.

Mr. Bowman announced that he is preparing a paper upon similar lines but of much broader scope and that he will be pleased to deliver it, when completed at some future meeting.

A general discussion followed the address in which the majority of those present participated. Mr. Cole, our active Past President, was on the firing line most of the time and our only regret is that Mr. Bamford was unable to attend and do a little skirmishing with him.

The topic under consideration was so interesting that more time than was originally planned was taken up, and therefore upon suggestion of the members, the "Discussion on Construction Camps," was tabled under the next regular meeting.

The next meeting, as announced on the front page, will be held on Thursday, October the eighth, at eight o'clock in the evening, in the rooms of the Society, New York. "Construction Camps" will be the subject for discussion. This will be an open discussion and all our members in and about New York who have any data upon Construction Camps are requested to attend and participate. This subject is receiving considerable attention throughout the country and in the technical press at present, and this meeting should be of vital interest and benefit to every contractor. You are all earnestly urged to put in an appearance and that you will not overlook coming take your blue pencil and mark the date on the calendar now, OCTOBER 8th. Come and spend a pleasant and educational evening with your fellow members.

The Inspector and the Contractor

DURING the last 25 years the amount of construction work has been so enormous in volume as to make the previous performances in that line by comparison seem little and unimportant. There has been in addition to a vastly increased volume a great advance in skill in design and construction, in the application of scientific principles and methods, and in the adaptation of machinery upon engineering work.

With this evolution and coincident with it there has followed a development of the contract system now in general vogue by the national, city, county and state governments and also by the great corporations which brings into relation the engineer, the inspector and the contractor, and the works which these three agents are now performing are probably the most enduring contribution to this particular period of our civilized development. The following discussion of the mutual relations of the engineer, inspector and contractor is taken from the paper presented before the latest annual convention of the American Road Builders' Association by Frederick L. Cranford of Brooklyn, N. Y.

The nineteenth century's greatest work was scientific along many lines; agricultural, mining, mechanical, electrical, medical and surgical, but in no instance has the development been greater and the results so stupendous as in the engineering work witnessed in the construction of our railroads, canals, water power, city building, road building, harbor development, etc.

The organization which in the main performed this work was the contract system with which we are all familiar, and therefore the relation to each other of the engineer, the inspector and the contractor, who may be said to constitute this organization, is a very important factor in the machinery of our present day civilization.

Within the memory of many actively engaged on public work, the duty of the engineer was limited to the drawing up of plans and specifications of work and his relation to the contractor and to the work was largely that of a surveyor, giving lines and grades and making estimates.

The inspector in many instances was not a subordinate of the engineer, but reported directly to the executive officer in charge of the work and frequently owed his place on public work to political considerations, rather than to any knowledge, experience or ability that he had. The executive also exercised a very much greater measure of control over both the contract and the contractor. The abuses which grew out of such a system were many and of such serious proportions as to threaten for a time the stability of the contract system.

With the perfecting of the organization which has largely taken public work out of politics and placed the engineer in charge, there has come, particularly to our cities, the only important advance in our municipal governments and it is a fair statement to make that this advance is due to the engineering profession.

The dominance of the engineer on our public work developed a conflict which raged with more or less severity between the practical and the theoretical and this conflict has been the important cause of most of the differences and disputes between us.

The rule ofthumb and the theoretical formula will always be a source of contention between the purely scientific engineer and the practical man—the former being skeptical of the value of the rule of thumb and the latter contemptuous of the theory of the engineer. When, however, both have had sufficient experience to allow them to grasp the fact that theory and rules of thumb spring from the same source if they are correctly interpreted, they will not be so far apart.

The contractor, as the practical man, has found during the last two decades an increasing necessity for technical knowledge in the success of his work and a great improvement along these lines has already been accomplished. Is it not just as essential, if not more so, for the technical man to acquire a better and more sympathetic knowledge of the practical?

An engineering work is an economic problem always and the economic design and execution of any given piece of work must of necessity be greatly affected by the many practical considerations of its location with respect to transportation, labor, supplies and the geographical formation and o fthe technical and mechanical skill needed in its execution. The scientific engineer will not find the success he owes to his work or to himself without a proper knowledge of the practical problems involved. If the engineer's scientific knowledge is not of use to produce better work for less cost with proper relations to future development, it has been misdirected.

The young engineer just out of college, placed as he usually is as a surveyor, lineman, or draughtsman, without authority or responsibility except as stated, is, I am convinced, not given a fair chance to acquire either the scientific or practical skill needed in his profession.

There is a noticeable difference in the number of inspectors employed on public and private work, political considerations being still visible as a cause for this difference. A large number of inspectors is not helpful, but practical skill and experience are necessary to proper inspection. It has been our experience that a small number of inspectors have not only been of assistance to hold within proper limits overambitious foremen, but have been of great assistance in matters of more importance, namely, the safety of the work, the public and the workman.

A little less politics and more responsibility will strengthen the inspector in our organization just as it has benefited the engineer. It may sound somewhat strained to talk about curbing politics with regard to inspectors, contractors being so free from such contamination, but seriously, there is no doubt that political considerations were the important cause of writing into our public work contracts and specifications the usual iron-bound clauses in which the contractor surrenders any and all rights he may have as a citizen or under the laws and constitution of the state and nation calculated to hold him, his successors, assigns and his heirs to perform without cost any foible or eccentricity of the engineer and of which the engineer is the sole judge. Following are two clauses from contracts for the construction of the New York Subway.

The specifications and contract drawings hereinafter mentioned and taken in connection with the other provisions of this contract are intended by the Board to be full and comprehensive and to show all the work required to be done. But in a work of this magnitude it is impossible to either show in advance all details, or to precisely forecast all exigencies. The specifications and contract drawings are to be taken, therefore, as indicating the amount of work, its nature and the method of construction, so far as the same are now distinctly apprehended. The railroad is intended to be constructed for actual use and operation as an interurban railroad of the highest class, adapted to the necessities of the people of the city of New York. The contractor shall construct and complete the railroad in the best manner, according to the best rules and usages of railway construction, and if in the specifications or contract drawings or in the provisions of this contract, any detail or other matter or thing requisite for such construction be not mentioned, nevertheless, the same is deemed to be included, and the contractor hereby undertakes to do the same as part of his work hereunder. And it is expressly agreed that the price to be paid to the contractor as herein prescribed includes full compensation for every such detail, matter and thing.

To prevent disputes and litigations, the engineer shall in all cases determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this contract; shall determine all questions in relation to the works and the construction thereof, and shall in all cases determine every question which may arise relative to the fulfillment of this contract on the part of the contractor. His determination and esimate shall be final and conclusive upon the contractor, and in case any question shall arise between the parties hereto, touching the contract, such determination and estimate shall be a condition precedent to the right of the contractor to receive any money under his contract.

Could there be a greater compliment paid to a man than this engineer pays to the contractor that tackles such a job? Yes, the compliment to the engineer paid by the contractor when he signs that contract.

A specification for any given piece of work has an underlying and fundamental meaning. It is a description of how to secure the construction with given materials of the best character of work obtainable and the relation which we bear to one another is largely governed by it. If the meaning be ambiguous and the requirements vague, it is very easy for the relations to degenerate into an effort to see how much each can get away with; a greater simplicity and a larger measure of fair dealing would seem to me to point to a great possible improvement.

While the unlimited authority given to the engineer to interpret and finally determine the meaning of the contract provisions is in practice nullified first by enlarged estimates to meet the risk of an improper decision and secondly by the enforced decisions of our courts holding that this power is really not conclusive, still some method should be devised which would not only limit this seeming arbitrary power of the engineer to make or break a contractor, but would also retain his authority to control and direct the progress of the work.

Public work in the United States is largely now upon a very high plane of accomplishment. Our great private work has been heretofore free from scandal and corruption, but curiously our organization (that is, the contract system, or the engineer, the inspector and the contractor), is in this particular, I believe, to-day in greater danger from these causes upon private work for great corporations than upon public work.

The work on the Panama Canal is an illustration, and the only great illustration on which our organization did not work together. My belief is that it only proves the rule as an exception and that the elimination of the contractor in that instance was proper and best.—*Engineering and Contracting.*

Value of System in Contract Work

Details of Organization which make for success---Advantage of Timing Construction---Suggested Form for Sub-Contracts

By D. Crain, Jr.*

HOW does a successful contractor plan his work—by days—by weeks—by jobs? To tell that, in detail, is itself a pretty big contract, and isn't the easiest thing in the world to do; but I have handled a few big contracts in my time, and this may not be too difficult.

I am the senior member of a more or less successful contracting firm in a certain good-sized city on the Ohio River; and while we haven't got everything figured down to the finest possible point, yet there are a number of things which might be said to constitute our system, our plan of doing business, and which we never deviate from.

To begin with, the work is divided between my partner and myself, according to that which we can do best. He is possibly the better superintendent, and he therefore attends to all the outside work, making the round of all jobs which we have under construction, seeing that material is on the ground and the like—all the numerous details that come up and have to be seen to, in spite of the fact that we have a capable superintendent. I handle the office, making up estimates, attend to the payment of bills, the correspondence, and all that sort of thing. And we are both kept busy enough, too. I don't mean that I never oversee any of the work, nor that he never makes a contract or helps figure an estimate on a job; but I do mean that we make it a point not to be on the same job, at the same time—that's where the system comes in.

We figure that one of us can do a thing, in most cases, just about as well as both of us together could do it, and that it would therefore be poor business to waste the time of one of us helping the other to do a thing which he could do alone. The only exception to this is one hour of the day—the noon hour. We make a rule to lunch together whenever it is practicable, because we have found it a good idea to get together at that time, when things are somewhat relaxed, and have a talk while we eat. It's a good time to untangle little matters that have come up, and then each can get any advice he wants of the other. It is a sort of council of war, where plans can be laid and courses of action decided upon, whenever necessary; and we both go back to work feeling that we are not alone—that we have a good man behind us!

Then, we always save some time that others waste, not to mention incidental damage to materials, by not being in too much of a hurry to start on a job. That may sound somewhat peculiar, but it is the exact idea I want to convey. Very frequently, in fact, nearly all the time, as soon as the plans and specifications are complete and the contract is made, the owner is in a wild rush for the work to begin. He sees no reason for an instant's delay, and is utterly unable to understand why the fool contractor stands around with his hands in his pockets and waits for days, and possibly weeks, before beginning the job.

The point is, of course, that we are not standing around with our hands in our pockets, by any means. Why begin excavation on a medium-sized or small building in such time that it will be finished long before your foundation material could be on hand, and be caving and possibly filling with water in the meantime? Or, what is more usual, why complete your foundation, and have your basement open to the weather, before you have completed arrangements for the delivery of frames, so that the job can go right on up? The same thing applies where there is any particular kind of brick to be used, especially, of course, if it is in the nature of a special order. And mill work should be ready at the time when it is needed, in order to prevent delay in the work, having men on your hands idle half of their time. That sort of thing eats into profits, and is entirely useless. A little foresight is all that is necessary. The delivery of every scrap of material can be arranged for in advance, to be on the ground just when it is necessary, according to a definite program; and yet I have seen builders who neglected this first essential to a successful job.

Where the material required is such that it has to be ordered specially, and always where it must come from out of the city, I take particular pains to see that there will be no hitch in delivery—that is, none that will leave me without legal recourse. If it is a small quantity, I usually order it at once, and have it delivered, as the certainty of having it on hand makes the immediate investment worth while. If it is a large quantity, however, I make a formal contract, and have a penalty clause just like that which is contained in our contract with the owner, so that if the factory, or quarry, or whatever it is, falls down on its contract, we are protected.

It goes without saying that we have at hand on each job complete detailed plans and specifications, ready for reference all the time. In addition to these, however, we also have a complete set of the sub-contracts made, so that the superintendent and foreman on the job can at once ascertain what sub-contractor is responsible for any part of the work or material, at any time the information becomes necessary.

A SUGGESTED FORM.

Our sub-contracts, by the way, are made up on a form which we have devised, which we think is pretty good. On one side we have a short proposal blank, running about this way, with date-line and address:

Gentlemen:

We propose to furnish all materials and labor and do the.....for ...the.....job, or building, located on.....street, between ..... and ..... streets, being No. ..... in the City of ....., County of..... and State of ..... said work and materials to be in accordance with the plans and specifications as prepared by ....., Architect, and in order that there may be no misunderstanding, we will further state [Here is a blank space for such further remarks as may be deemed necessary.] For the sum of ..... Dollars.

We agree, upon written notice from you, to start the work within ..... days after receipt of said notice, and push said work to completion as rapidly as possible.

The blank has space for the sub-contractor's signature and an acceptance line for us. On the other side of this form are eight ruled spaces, all just alike, under the following printed lines:

"Received of (our firm) partial payments on account of work and material as per contract on the reverse side as follows:"

And in each space is room for the date, signature of the firm, and the amount of the partial payment. At the bottom is a slip, which can be detached by a perforation, in which to sign a receipt and release in full, when all payments are made. The detailed statement of partial payments is filed alphabetically under the name of the sub-contractor, with all other matter relating to his contract, and the slip is turned over to the owner, or placed in his file, as evidence that the property is clear of liens on the part of sub-contractors.

It might be mentioned here that there is but one check-book out of which drafts are made on the firm account, and that is kept at the office. Our pay-roll, of course, is handled by one check, and the men get their money in cash, in the usual pay-envelope. I have known contracting firms, though, who never knew where they stood on a job, because two or three members were issuing checks here and there, and it was simply impossible to keep any track of them.

We do not keep a permanent crew on hand, work or no work. I have known of contractors who do this, but we have never found it necessary. We usually have plenty of work for our good men, and have little trouble in keeping them busy; but in times of slack work, we let them off in the reverse order of their value to us; and I have seen the time when we have as many as three or four foremen working on one job—not as foremen, you understand. They were all practical mechanics, and in order to keep them busy we would simply place them on the job as journeymen. And if we came across a foreman who was too proud to work that way we would immediately fire him, because we have no use for such examples of the artistic temperament in the building business.

We have a bookkeeping system which enables us to know to a cent what a job has cost us, and that is considerably more than some men know; and yet it is absolutely necessary, in order for the contractor to find out what his profit—or loss—is, as the case may be. We have three ledgers, in one of which is recorded all that we buy, with the credits to us by return of material and cash payments; in another, the materials put into the job, and payments made to sub-contractors for work and material; and in the third, our accounts with the owners. There are appropriate accounts in the first two ledgers for every head under which expenditures on a building may fall, and not a cent is spent for even carfare that is not properly charged. When we get through a job we know just what we have spent, and we know just what we have spent it for; we know what we have received in payment for the work. And from these facts, it isn't hard to discover just how we stand on the job.

* In the National Builder.

Significance of Highway Maintenance

Prof. L. S. Smith

We, in America, fail to understand that the main reason why our roads are so inferior to those of Europe is the general lack of an adequate system of maintenance. A century of experience has taught the European engineers and taxpayers that the time to begin the repair of a road is the day after its construction is finished.* In America, however, we put off the repair of our roads until the day after they are worn out. As a result, while the European road surfaces are well maintained and long lived, the American roads are too often rough and short lived. This criticism, while generally true of country highways, is also, to a lamentable extent true of the city pavements. We know how to construct as good roads and pavements but we have yet to learn the need of their maintenance. This misconception of the significance of road maintenance is well illustrated in a current engineering magazine in which a road commissioner, after describing how well he has constructed an asphalt concrete road "subject to the heaviest travel," says: "We feel that we will not be required to do anything in the way of repairs for eight or ten years."

Alas if such confidence were only justified!

It is the writer's experience that such a pavement is certain to show some weak spots after the first winter, if not, indeed, the same season. These defects, though insignificant and easily and cheaply corrected at first, are soon enlarged by a heavy traffic to such an extent as to greatly impair the life of the pavement.

In no other construction does the old adage, "A stitch in time saves nine," apply more aptly than in road repair. This principle has been proved so many times in the history of road construction that the Europeans consider us very stupid indeed not to accept and act on it. This failure on our part to appreciate the function of maintenance as an important element in the economics of highway construction is unfortunately not confined to our humble country path masters but is shown by officials high in authority. It is well understood abroad that both the construction and maintenance of roads have a single object and that both are necessary to attain that object. It may well be that a better service will be afforded by a poorly constructed road, well maintained than by a well constructed road without maintenance. At the present time taxpayers are showing much enthusiasm for the construction of hard surfaced highways, and it is important that this enthusiasm and interest in road building shall be fostered and encouraged. Can anyone doubt if the first pavements prove a disappointment because of their short life, that the effect of such failure will tend to discourage further road building?

ditional reason for systematic and thorough maintenance of such roads. For even with good maintenance, there will usually be some difficulty in preserving the road for a term equal to the life of the bonds, and, lacking such maintenance, most highway construction will have worn out long before the bonds are paid. This has actually happened in some of our American states and municipalities.

There are many miles of expensive macadam roads in New York State, the life of which will be less than twenty years, all built out of the proceeds of bonds running for 50 years. Such a system of financing good roads cannot be characterized as anything short of dishonest, for the reason that we thereby transfer to the backs of our children the burdens which we of to-day should bear. It does not require a prophet to see that tho' the present road problems are serious, those of the future are quite certain to be much more so. Again the failure to maintain the New York roads during the first few years succeeding their construction has resulted in an excessive cost of maintenance during the past three years of over $1,000 per mile per year. But New York State has learned from experience the lesson of continuous maintenance, and other states may well profit by her example. During the year of 1912 the maintenance department of New York State highways employed 735 patrolmen, who cared for approximately 3.151 miles of completed highway. Each patrolman furnished a horse and cart, together with the necessary small tools. The work of maintenance under this patrol system consisted in keeping the surface of the paved roadway in as nearly perfect condition as possible, keeping the dirt shoulders smooth and safe for travel; culverts and drainage system free from obstruction; weeds, grass and brush cut within the limits of the highway and in making small repairs to structures and guard rail. In addition to these duties, the patrolmen filled the ruts and repaired small defects which appeared in the road as a result of heavy travel.† The total amount of money spent by New York State in 1912 on this maintenance and repair work amounted to nearly $3,000,000. Contrary to the common belief, macadam roads there are not permanent structures.

One reason for the general indifference in the United States toward this question of maintenance is found in the failure to visualize the future traffic. For example, the officials of one state highway commission took a traffic census several years ago on country highways and found only a light traffic, they therefore conclude that a construction suitable for such traffic is all that should be provided. As a matter of fact the building of a hard surfaced road at once disturbs the old equilibrium of traffic by attracting to the new road new traffic, which formerly sought other routes. This can best be illustrated by giving some statistics‡ from a paper by Col. Sohier, Chairman of the Massachusetts State Highway Commission, and presented by him at the Convention of the American Road Builders Association at Cincinnati. Briefly stated, he found the average daily traffic on one road, which in 1909 was 185 vehicles, had increased in 1912 to a daily average of 586 vehicles, an increase of 217 per cent. in three years. The increase of motor-driven vehicles was 200 per cent. and of heavy teams 288 per cent. On another road the average daily traffic increased from eighty-one vehicles in 1909 to 333 in 1912, or 300 per cent. In this case motor-driven vehicles comprised 42 per cent. of the traffic in 1909 and 75 in 1912. These examples are probably indicative, in general, of traffic changes in other states, though of course not always with the same percentages. The point which here needs emphasis is, that if a dirt road requires little or no maintenance before being macadamized, after such improvement the increase in traffic which it is certain to attract will render some maintenance imperative. This has been repeatedly shown to be true in every Eastern state, and it is high time that the Western states profited by such experiences. The situation would only seem to require that the full facts relating to this experience should become widly known to our citizens.

To a student of highway economics, the alarming rate at which maintenance expenses increase, when any considerable amount of the state highways have been improved, is certain to cause apprehension, and should be of vital interest to the taxpayer.

Turning again to New York State, we take the following figures from the published report of the State Highway Department.

Cost of Maintenance.

	Mileage	Maintenance Cost	Cost per Mile
1909 ..	1787	$1,500,000	$840
1910 ..	2137	1,800,000	840
1911 ..	2622	2,122,763	1,001
1912 ..	3151	2,919,959	926
1913 §.	3813	5,000,000	1,311
		Average	$983

Heavy traction engines, fast moving automobiles, and heavily laden narrow steel-tired wagons are responsible for a very large part of this excessive cost of road maintenance. In all justice to the taxpayer this class of vehicles should be made to contribute to the maintenance fund their just share of such damage. This principle has long been recognized and acted on in Europe, and, to a lesser extent, also in some of our states. Most states exact an automobile license fee, but often not more than five dollars per year, an insignificant sum if intended to compensate for the wear of the roads. Instead of a flat sum it seems more fitting that the license fee should be made proportional to the weight and horsepower of the vehicle. In England a 45 H. P. touring car would be required to pay a license fee of about $100 per year. Such a tax has been justified, not only as a partial return for damage done to the road through the use of the motor car, but also as coming from a class to whom such a tax would be far from a burden.

Another method of securing the funds for maintenance, and one largely used in Europe, is the taxing of all gasoline used in motor cars. It has been estimated that a tax of six cents per gallon (the tax in England) would have produced a fund of $1,600,000 in New York State in 1912. Such a tax would have the advantage, also, of being proportional to the use of the roads. This method of taxation will be recommended to the next New York legislature by the State Superintendent of Highways, and would seem to deserve a wide adoption.

But better still than paying for excessive wear to our roads is a system of state legislation designed to prevent such wear. Several Eastern states have already enacted such regulations. Some of the provisions of the New York law include the following: (a) Traction engines are prohibited from traveling over

improved highways for threshing purposes after January 1, 1914, and, in the meantime, such engines must pay for any damages. (b) The tires of each wheel of any steam roller, automobile truck motor, or other vehicle shall be smooth, and the weight of such vehicle, including load, shall not exceed 800 lbs. upon any inch in width of the tire wheel or roller. (c) No motor or other power vehicle shall have a greater width than 90 inches except traction engines 100 inches. (d) No traction engine, steam roller, automobile truck or motor carrying a weight in excess of 4 tons, including the vehicle, shall be operated at a speed greater than fifteen miles per hour, and no vehicle carrying a weight in excess of six tons, including the vehicle, shall be operated upon any state highway at a speed greater than six miles per hour, when equipped with iron or steel tires nor greater than twelve miles if equipped with tires of hard rubber.

With a force of over 700 patrolmen evenly distributed over the state highways, and assisted by the other regularly constituted peace officers of the state, it would seem entirely feasible to enforce the above laws and regulations. There can be no doubt that such enforcement will go very far toward preventing the present excessive wear on improved roads. Neither European nor American roads have been built to withstand the present traffic demands, especially the fast moving auto and heavy motor truck. Even the expenditure of $45,000,000 per year on the widely heralded French highways has not prevented these water bound roads from wearing rough where subjected to excessive motor traffic. The general substitution of the motor vehicle for the horse drawn vehicle, while greatly reducing the maintenance cost of city pavements built of wood, stone, brick or asphalt has had exactly the opposite effect upon country highways built generally of some form of broken stone or gravel.

In the judgment of our most experienced engineers the road of the future, designed for heavy fast moving traffic will make use of our immensely valuable broken stone and gravel resources in a permanent concrete foundation, provided with some comparatively thin and easily replaced wearing surface. If such wearing surface be made of some kind of bituminous material which could be remelted and laid again, the maintenance costs involved would seem to be a minimum. In a large part of the Mississippi valley the use of vitrified brick on a concrete base is becoming deservedly popular because of its long life and resulting uniformly low cost of maintenance. At the present time numerous American road officials are experimenting with various mixtures of concrete for both foundation and wearing surface. The reports on these experimental pavements are very conflicting except on one point, viz., that concrete roads have not been able to withstand the abrasive action of heavy steel tired vehicles, though well suited for motor traffic.

The writer disclaims any partiality toward foreign practice of roadmaking. In fact, except for their superior systems of road maintenance, his investigations fail to show any superior knowledge on road construction over that possessed by American engineers. Indeed so far as the theory and practice of asphaltic materials for road purposes is concerned, European engineers frankly confess that they look to America for the correct solution of present problems. Again, in making any comparison of highway conditions in America and abroad, due allowance should be made for the fact that European road systems have taken a century for their construction; in fact, many of their main roads were first built by the Romans over 1,500 years ago. Moreover, this great work was first initiated, and in very large part supported by an ever present military necessity.

In America, the good road movement is scarcely fifteen years old. In this brief experience we have learned how to make our standard roads as well suited to our comparatively thinly settled country and the attendant traffic conditions as the French roads are suited for French conditions. One might go farther and say that no county in England has a system of roads so permanently constructed as the 1,700 miles of brick pavement in Cuyahoga county, Ohio. It is not in the construction, but in the maintenance of our roads that we need to copy from Europe. When will we learn that pavements are not permanent structures, but instead require constant repair and maintenance? We will be very stupid indeed if we do not accept and take advantage of the experience of Europe and our own Eastern states. The highest efficiency and continuity of management will be promoted by placing the maintenance of all state or main trunk roads in the hands of the State Highway departments, out of the influence of petty county politicians.

Most significant to highway engineers and most encouraging to the taxpayer is the present well founded confidence in and reliance on scientific methods, both in the selection of road materials and in their incorporation into the completed road. But only after our people are equally well converted to scientific maintenance can we realize our ambition for good roads.

The Wisconsin Engineer

G. W. ANGLE IN THE MINING BUSINESS.

A deal of much importance to the State of Montana has recently been closed. George W. Angle, Consulting Engineer, Charter member of this Society, and his associates have bought over a number of mining claims in the Cataract Mining District, Montana. They have formed a company called the Montana-Boston Copper Mining Company, Inc., and from reports received will operate the present property on a much larger scale than has been the practice heretofore.

The group of claims taken over by the company consists of five patented claims with ore bodies exposed to the surface for a distance of approximately 4,000 feet. Commercial ore has been found in every opening on the surface.

The total production of refined copper, gold and silver, taken from the smelter returns, during the operations before its recent purchase, were as follows: Copper, 107,000 pounds; silver, 18,400 ounces; gold, 384 ounces. The above is a remarkable showing for a property that was worked on a small scale.

We wish Mr. Angle every success in carrying on this new work.

Engineering Law

By Wm. B. King*
Washington, D. C.

RECENT DECISIONS OF THE SUPREME COURT.

At the last term of the Supreme Court a good many decisions were rendered of general interest to engineering contractors—rather more than the usual number at one term.

General and Special Provisions in a Contract.

In the case of Hallerbach v. United States the specifications for the repair of a dam in the Kentucky River declared that certain conditions would be found behind the dam—specifying these conditions in detail. In other portions of the specifications the contractors were cautioned that they took the work subject to their own examination of the difficulties attending it and of all local conditions.

When they began their work behind the dam, they found a very different state of affairs from that represented in the specifications. A very large expense was incurred by them in excess of what would have been incurred had the conditions been found as represented. They insisted that the United States was bound to pay them this additional expense. The claim was refused. It was then taken before the Court of Claims, which upheld the government's contention. The Supreme Court overruled the decision of the Court of Claims and said that the government, having represented the exact conditions to be found behind the dam, was bound by its representations and could not relieve itself from its representations by the general clauses of the specifications. The court said that the "specifications spoke with certainty as to a part of the conditions to be encountered by the claimants and added that "this positive statement of the specifications must be taken as true and binding upon the government." Accordingly, judgment was rendered for the contractors.

The value of this case lies in its general application to similar specifications. It is a decision in the line of absolute justice to contractors and declares that owners must keep good faith with them in their specifications.

Liquidated Damages for Delay.

This is the subject of very many decisions. The recent decision of the Supreme Court in regard to the United Engineering & Contracting Company enforces a rule of value to contractors. The original contract contained a provision for liquidated damages for each day's delay. A number of supplemental contracts were entered into, necessarily extending the contract term. After these supplemental contracts various delays occurred, some chargeable to the contractor and some to the government. The government insisted upon deducting daily liquidated damages for all the contractor's delays. The contractor sued in the Court of Claims for this and insisted

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that the liquidated damage clause in the contract was nullified by the supplemental contracts. He said that the agreement was to pay liquidated damages beginning from a certain date; that the government by its supplemental contracts made it impossible to finish the work on that date; and that there was no agreement to pay liquidated damages beginning on a subsequent date to that originally fixed in the contract. Both the Court of Claims and the Supreme Court upheld the contractor in this contention. They said that the government should not insist on liquidated damages under a contract which could not be completed on the date fixed, by reason of the additional work added to it by the supplemental contracts. The Supreme Court said that to do this would permit the government to recover damages for delay caused by its own conduct."

Extra Work Caused by Government.

In the same case conditions were declared under which the government was held liable for extra work not specified in the contract. Standard valves were installed under the specifications without gear casing, there being no provision requiring it. The valves were to be so operated that no workmen need be near them. The government built a walk in the pumping plant for the use of the workmen, which brought them close to the high-speed gearing. This then had to be incased. The court said that the contractor was entitled to payment for the expense of incasing the machinery, because the government was responsible for the need of providing the casing.

The principle here declared is applicable to all engineering contracts and is certain to need enforcement in a good many instances of construction.

Breakage Caused by the Government.

The government's water system for which this machinery was installed was subject to sudden pressure not disclosed in the specifications. There was a break in one portion of the contractor's priming system caused by this pressure, which was immediately repaired. Subsequently another portion of the work was broken by like pressure and this was repaired. There was a provision in the specifications that "all risks of damage or injury from any cause to property or persons" should be assumed by the contractor. The Court of Claims and the Supreme Court both held that the contractor had not agreed to assume risks imposed by the government itself by this general provision.

This decision illustrates the tendency of courts to render equitable decisions whenever they are not prevented from so doing by the stringent terms of the contract.

Terms of Contract are Binding.

In the case of Miller v. United States, the contractor had undertaken to carry the mails over a post route in Alaska. The contract was for a term of four years and it costs the contractor over $150,000 to perform it for two years. He received less than $100,000 for his services under the contract. During the remaining two years of the contract he would have made a profit. At the close of two years the Postmaster General discontinued the service and paid the contractor one month's extra pay for the discontinuance.

This was done in accordance with a stipulation which appears in all postal contracts and which formed a part of this contract, to the effect that the Postmaster General could discontinue the contract by allowing one month's extra pay.

The petitioner showed a very large expenditure without reimbursement and stated in great detail that the mail route involved almost insurmountable difficulties, such as cutting trails, building and repairing bridges, erecting sheds, carrying provisions for men and horses and overcoming obstacles of ice, snow and flood.

The Supreme Court said of these difficulties that they "called for the manifestation of courage, the exertion of great knowledge and the willingness to make sacrifices."

Under these circumstances, the contractor asserted that it would be inequitable to enforce the one month's extra pay provision and that it could not have been intended by the parties that this service should be discontinued as actually occurred. The conditions, the contractors asserted, were such that undoubtedly the Postmaster General and the contractor contended that the service should continue for the full four years, notwithstanding the provision for discontinuance.

The Supreme Court answered this plea by the enforcement of the rule that a contractor must stand by his contract even if it involved a very great hardship to him. It sustained the decision of the lower court, and ended its opinion by the following words:

"Let it be conceded that if the truth be admitted of all the facts as to the unforeseen difficulties, the stress of storm and blizzard and snow and ice and freshet, which prevailed as averred over the trackless wilderness through which the mail route extended a case of great hardship would be established, the very truth of the averments referred to also naturally suggests the reasons which in the exercise of a wise discretion may have called into play the exertion of the power to discontinue the contract in the public interest and for the public benefit. As under the conditions stated the hardships alleged were but the result of a mistake of the petitioner in making an improvident contract, relief can only be obtained at the hands of Congress."

This case is one of the many illustrations of the same principle that when a contract is signed, it is to be enforced by the courts, and that the parties cannot escape the consequences of their own folly in signing unwise contracts.

Annulment of Contract.

In another case it appeared that the United States entered into a contract with Rudolf Axman to excavate a channel in San Pueblo Bay, California, and to deposit the spoil behind bulkheads or dikes of suitable construction, according to the directions of the Engineer officer, and within certain limits.

The Government annulled the contract on the ground that the contractor had failed to comply with it. It thereupon relet the contract, but made a change, namely, that the spoil should be deposited in deep water and behind designated bulkheads.

A higher price was paid under the new contract and the government sued the original contractor and the surety for the difference between the original and the second contract prices. The government offered to show that it was no more expensive to deposit in deep water than in the manner originally provided for, and indeed presented correspondence showing that the original contractor had asked for this as a privilege.

The Supreme Court said that neither the contractor nor the surety could be held for the difference between the cost under the original contract and under the new contract, because they said that the contracts were different and that the change was material.

This is in accordance with the general rule of law enforced in many cases, that a failing contractor cannot be held for the excess cost of completing a contract unless the contract, as completed, is substantially the same contract as that originally made.

This case was rather an extreme illustration of the rule and illustrates the care with which the rights of contractors are enforced even against the United States.

Rights of Material Men.

A decision rendered shortly after this, in the case of the Equitable Surety Company v. MacMillen, would seem to be somewhat in contradiction to this were it not for the care with which the Supreme Court pointed out the principles on which the later case was decided.

A contract was made with the District of Columbia to build a schoolhouse. The bond given for this purpose was in the form now required in all United States and District of Columbia contracts, guaranteeing not merely the faithful performance of the contract to the United States but also the payment of all claims of material men.

After the execution of the contract the District of Columbia altered the plan by changing the front of the building from one street to another and causing a considerable increase of expense to the contractor.

A suit was brought against the surety upon the contract bond by a material man. The surety pleaded that the change in the contract released the bond.

The Supreme Court said, however, that although this rule might be applied in the case of the United States or of the District of Columbia, to whom the bond was directly given, it did not apply to a material man. He was not responsible for the change in the bond and his rights could not be disposed of by the act of the United States in making a change of this character.

The Supreme Court said that a case might be supposed where the change would be so great as to be beyond the contemplation of the original contract.

They did not undertake to decide the question which would arise under such conditions, but left that open for further consideration.

It is thus seen that the Court ruled with liberality in order to sustain the right of the material men to recover.

Action by Material Men.

In another case decided about that time, United Staetes v. McCord, the decision was against the material man under a similar bond.

The statute provides that a suit may be entered into upon the bond by the United States and that the material men who have not been paid may intervene in the suit of the United States. It then adds that if the United States entered no suit within six months, the material man may file a suit upon the bond.

In this particular case, the material man found that the United States did not propose to enter any suit, and therefore brought suit before the six months had elapsed.

The Supreme Court said that the action upon the bond was an action granted by the statute and that the material man was bound by the terms of the statute and had not rights beyond it. They said that the right of action did not accrue until the United States had had six months in which to determine what course it should follow; that in this case the material man had brought his action prematurely, and that it could not be sustained.

Accounting Department

Conducted by Harry M. Smith*
Certified Public Accountant.

A professional man who presents to the public in book form his views on certain points of his profession is usually performing a thankless task; his work being criticized more or less freely, not only by members of the same profession, but also by others who are not entirely competent to criticise. Nevertheless it is well that certain men have the courage to state their convictions in writing and it is also well that criticism is made of such writings as such tends to broader views and a better understanding of the subject discussed.

In taking exception to certain statements made in a book on Cost Keeping, published about five years ago by two well known engineers, the sole purpose is to do justice to modern accounting methods. A careful reading of certain passages therein gives the impression that accounting as it is relating to cost keeping is something that cannot be depended upon to any great extent and that it is necessary to restore to engineers to obtain accurate costs. It is perhaps reasonable to state that good accountants are seldom good engineers and it may be that the reverse is also true. "Every man to his own trade." In the passages quoted, however, it will be noted that bookkeeping is mentioned rather than accounting and it may be said that there is a vast difference between the two.

At this point it may be well to quote the following passage to which this exception is taken:

"**Cost Keeping Defined.** For the purpose of the discussions in this book, a distinction must be drawn between bookkeeping and cost keeping.

"**Bookkeeping,** as we treat it, is the process of recording commercial transactions for the purpose of showing debits and credits between different 'accounts.' These 'Accounts' may be individuals or firms, or they may be arbitrary accounts, the latter being an evolution in bookkeeping that came after individual accounts became so large or so complicated as to be insufficient to show the status of the business and the profits derived from any given transaction.

"**Cost Keeping,** as we treat it, is the process of recording the number of units of materials entering into the production of any given structure, or into the performance of any given operation. To these units of work or materials, actual or arbitrary wages or prices may or may not be assigned. The object of cost keeping is primarily to show the efficiency of performance; hence actual money disbursements need not be recorded, as in bookkeeping. This distinction is vital and will be discussed at greater length.

"Differences between Cost Keeping and Bookkeeping.—Bookkeeping was first devised and subsequently developed by merchants. Cost keeping was devised and developed by engineers. The merchant is a student of profits; the engineer is a student of costs. Although profits depend upon costs, there is a vast difference in the point of view of the merchant and the engineer.

"In the study of costs, as we have previously pointed out, the aim of the engineer is to reduce all costs to a unit basis, selecting such units as most closely conform to the theoretical unit of work—the foot-pound. This study often necessitates the use of several different units for the same class of work. It necessitates the recording of conditions, and the making of measurements—all of which is more less foreign to the fundamental idea of bookkeeping. Yet, in groping toward methods of cost keeping, it has become the practice of most contractors, manufacturers, railway companies, etc., to endeavor to develop a cost keeping system in the bookkeeping department. Hence we have to-day systems of bookkeeping that are wonderfully complex, and, withal, show very little that they attempt to show as to unit costs.

"Take, for example, the accounting department of an American railway. Here we find skilled accountants loaded up with a mass of work called for in distributing the costs to different accounts. Calculating machines that carry the cost of railway spikes out to the third decimal place are clicking away from morning to night. A prodigious amount of figuring is done so that scores of distributions may be made, without the error of a cent in the balancing of accounts. Yet, with it all, what do these railway accounts show as to unit costs? Next to nothing worthy of the name of cost keeping.

"Why Cost-Keeping Records Should be Kept Distinct from Bookkeeping Records: Many contractors and engineers confound cost keeping with bookkeeping and attempts are often made to make a cost keeping system so elaborate as to be a bookkeeping system, thus burdening the bookkeeping with a great deal of material that is not germane to it and piling the cost keeping under an avalanche of details and figures that are destructive to its economic value.

"Bookkeeping is an ancient art. Cost keeping is a development that is less than a generation old. Since cost keeping has resembled bookkeeping in some respects, it has been regarded as an evolution of bookkeeping, when, in fact, it was not originated by accounts nor developed as a part of accounting. We repeat that cost keeping has been evolved and developed by engineers, not by bookkeepers. It is an art and a science having objects differing radically from the objects of bookkeeping. Yet innumerable blunders have been made in the attempt to graft a cost keeping system upon a bookkeeping system. These blunders arise from a misconception of the functions of cost keeping and bookkeeping. Let us consider still further what bookkeeping is and wherein it differs from cost keeping.

"Bookkeeping in its original and simplest form consists of a record of debits and credits. Its primary object is to show obligations between individuals or corporations. By an extension of this idea, arbitrary accounts were created, such as Bills Payable, Profit and Loss, etc.; but, in all cases, the accounts were kept in the form of debits and credits. Hence the general object of bookkeeping is to show debits and credits.

"Now, what is the object of cost keeping? Primarily, its object is to show unit costs. These unit costs may be used as standards by which to effect reductions in costs, or as standards by which to estimate the cost of future work. Cost keeping, therefore, involves the use of standards of comparison, which do not enter into bookkeeping in its original form, nor can the use of standards be grafted upon bookkeeping without great confusion and complication. As above stated, perhaps the best example of the confusion and complication that follow such an attempt may be found in the bookkeeping of railway companies. Without discussing the matter at this time, we need but refer to the absence of satisfactory unit costs in the accounting records of railways and the great labor involved in digging out the data necessary to derive unit costs of the kind most useful to the engineer. The labor wastes that undoubtedly occur in railway construction and operation are attributable to the hybrid system of accounting which is supposed to be good bookkeeping and good cost keeping, without being good in either respect. Nor shall we dwell upon the inability of the chief engineers of railways to estimate costs accurately further than to point out that the accounting records are so involved as to be of little or no assistance to them.

"We shall now give in concise form some of the various reasons why cost keeping records should be kept entirely distinct from bookkeeping records.

"1. Since the primary object of **bookkeeping** is to show debits and credits, all accounts must be summarized in one book—the ledger. Since the primary object of **cost keeping** is to reduce costs, no book corresponding to a ledger is needed. Indeed, it is often desirable to have cost records of different classes of work kept in different books, in different ways, by different men, in order to localize responsibility as well as to apply different units as standards of comparison.

"2. **Cost keeping** should partake of the nature of daily reports by which a superintendent can gauge the daily performance and discover inefficiency at once. **Bookkeeping** accounts may not be, and usually are not, posted promptly or completely until some time subsequent to any performance.

"3. **Bookkeeping** records must balance to a penny. **Cost keeping** records need not be kept with mathematical precision, except in so far as bonus payments to workmen are involved. The object of cost keeping is to show efficiency, and this may usually be shown by approximations fully as well as by hair splitting exactness. Hence cost keeping records may be devised that will require far less clerical work than is necessary when mathematically accurate bookkeeping is used.

4. "**Bookkeeping** is a clerical function; **cost keeping** is an engineering function. It is a rule of successful management not to ask one man to exercise many functions, particularly when they are diverse in nature. An engineer is not interested in recording debits and credits, or in the rendering of bills—functions of the bookkeeper. On the contrary, a bookkeeper knows nothing about construction costs, but lacks the necessary engineering training to interpret cost records and to devise methods of reducing costs.

"5. A contractor who has an effective and simple system of bookkeeping naturally objects to a change to a more complex system, such as is necessary

* Asso. Member of the Society

when cost keeping is added to the bookkeeper's duties. Gilbreth's "Office System" contains an admirable method of bookkeeping without books, which is kept wholly distinct from cost keeping.

"6. When cost keeping is begun, it is well to start in a small way, taking some particular kind of work, like teaming, and applying a system of daily reports. When this phase of the work has been analyzed and organized, some other feature is taken up, and so on, thus developing a cost keeping system gradually. Resistance to change is bound to be encountered, and the way to overcome it is in this manner, a little at a time. Bookkeeping can not be changed a little at a time. A new system of bookkeeping means an entire revision all at once, for accounts are interdependent.

"7. Cost keeping records should state conditions, such as weather, distance of haul, etc., which are essential to interpretation of results. Sketches showing design of structure should form part of permanent cost records. Such things are entirely foreign to bookkeeping, and, if placed upon bookkeeping records, simply serve to confuse them.

"8. The bookkeeper enters bills for materials as they are received, crediting the firm that furnishes them. A barrel of spikes may be followed by a dozen picks on the bill. It is not the bookkeeper's function to trace the spikes to their place in the work, and, when the work is finished, to ascertain the total number of barrels of spikes used in a particular structure. That is the function of the cost keeper on the ground. The bookkeeper must show that John Smith Co. has been credited with the spikes. The cost keeper, on the other hand, cares nothing as to the particular firm credited. He is concerned only with the quantity of spikes and the use to which they have been put. It is hopelessly confusing to try to show in one set of records both credits, and unit costs.

"9. In studying cost records to ascertain efficiency, it is often necessary to have several different units as standards. On reinforced concrete work, for example, the primary unit is the cubic yard, but there should be at least three other units, namely, the pound of steel (for comparing costs of handling and placing the steel reinforcements), the thousand feet B. M. (for comparing costs of forms), and the square foot of exposed surface (not only for comparing costs of form work but costs of surface dressing). Cost records must be sufficiently detailed for these purposes, if not in every case, at least in some cases of concrete work. Bookkeeping records become hopeless of interpretation unless they are uniform, and, to be uniform, they must have few units of comparison. In brief, bookkeeping is not flexible. To generalize further, cost keeping costs must be divided by units of work done, so as to secure unit costs for comparison, which is a process foreign to bookkeeping.

"10. Since cost keeping has as its primary object the reduction of costs since comparisons of results secured by different men or different machines or different methods are necessary, it follows that standard wages and standard prices of materials must be used. It may happen that on one job the cement may be purchased at different times at prices ranging from $1.20 to $1.50 per barrel, and that common laborers may receive from $1.50 to $1.75 per day. In comparing unit costs a standard price of cement should be assumed, as $1.30 per barrel, and a common labor standard wage, as $1.50 per day. Then comparisons become standard wage, as $1.50 per day. Then comparisons become possible. A bookkeeper cannot assume any rate of wage or any price; he must give the actual wage or price. A cost keeper usually finds it desirable to use standard wages or prices which approximate the average, or actually are the average."

Comment and Discussion.

To begin with the distinction made between bookkeeping and cost keeping is very unsatisfactory and decidedly weak; the nomenclature being faulty and uncertain. Bookkeeping is held up to scorn, while cost keeping is represented as accomplishing wonders when directed by engineers. Again, bookkeeping was devised by merchants who were students of profits; cost keeping resulted from engineers who were students of costs.

As for the latter, while it may be very true, it doesn't appear unreasonable to state that for the average merchant or business man to be successful at any time, he must be a fairly good student of costs, in order to realize any profits. The entire burden doesn't rest upon the engineer.

Now as to the statement that a sharp line must be drawn between bookkeeping and cost keeping, actual practice has proven, at least to accountants, that such always results in serious difficulties. The combination of the two into one well designed system is the logical method of recording business transactions of any magnitude, large or small. A maximum efficiency being produced by a minimum of effort.

Cases frequently fall under the observation of accountants where attempts have been made to keep the costs apart from the general books of account and they usually have resulted disastrously for the management. The accounting systems performed their duties properly, but the cost systems, not being controlled by the accounting, proved inaccurate in every essential, although such are operated by reasonably competent men.

Costs to be of any value, whatever, must be accurate, otherwise but little dependence can be placed upon the results produced. Inaccurate costs are perhaps worse than no costs at all.

The statement that "the objects of cost keeping is primarily to show the efficiency of performance, hence actual money disbursements need not be recorded as in bookkeeping" will not altogether stand analysis. It is self evident that to obtain costs it is necessarily a vital matter that the money values be correctly recorded. If not, what are costs? Should statistics be desired as to the progress of excavating, such to be arranged with due regard for condition of soil, weather and what not regarding shipping of men or machines arranged on varying unit bases which will set forth the efficiency of all sorts of things, then costs are not being considered and money is of little value perhaps. But after all, in such a case, isn't the real test from the contractor's standpoint, the money cost of the excavating and shouldn't the disbursements be recorded?

The statement that bookkeeping is an ancient art is quite true; double entry bookkeeping having been introduced by the Italians about the fourteenth century and it has not been changed in principle since that time, single entry which is but a recording of items not controlled is obviously as old as civilization itself. The principle of double entry has from time to time been elaborated as to certain details, among which may be included cost keeping; it is a natural offspring and it is one that for accuracy is absolutely dependent upon bookkeeping methods. Certain points of cost keeping may have evolved from engineering practice, but such points are technical in their nature and are purely elaboration of the underlying principles of bookkeeping.

At another point mention is made of the relation of the bookkeeper and the cost keeper as concerns certain spikes and of the hopeless confusion that arises if the bookkeeper attempts to charge the spikes to the proper section of the work. It is a case that is somewhat exaggerated as nothing sould be simpler in actual practice provided there is a comprehensive accounting system; the requisition from Stores should cover fully such items and without any confusion whatever.

To sum up, while but a few points have been touched upon critically, such have been discussed in a friendly manner. One point in the book, however, is very evident and that is, that an accountant desiring material to build up a cost system would learn very little from even a careful perusal of the passage chosen for discussion.

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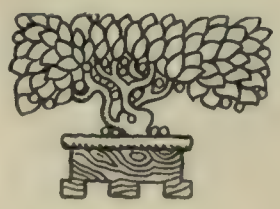

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The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, NOVEMBER, 1914 Number 11

AT a recent meeting of the Board of Direction of this Society a report of the record, efficiency and accomplishments of the various Committees, Technical Standards and otherwise was submitted by the Special Committee appointed to revise the present work of the Technical Standards Committees. It was very thorough and cited exactly what had been done by each Committee and Sub-Committee, individually.

¶ The report, in many respects, was gratifying because it showed the splendid work which some of the Committees have done to the end for which they were organized. The Chairmen of those Committees deserve the unstinted thanks of the Society,—and they have it.

¶ The records of some of the Technical Standards Committees, on the other hand, do not show up so well and a comprehensive analysis of the reports and the correspondence carried on with the Chairmen of these Committees leads us to the following conclusions:

¶ 1. Some of the subjects upon which our Technical Standards Committees are preparing standard specifications are entirely and excellently covered or are under consideration by other organizations which are in a position to accomplish those specific tasks in a satisfactory and equitable manner. Foremost among these stands the American Society for Testing Materials.

¶ 2. The objective program of the majority of our Technical Standards Committees is not of great direct and practical benefit to our membership.

¶ Giving the above facts the consideration they deserve, is it advisable, or necessary that this Society have Committees laboring with problems which do not directly affect its membership and which are already the sole objective of organizations whose inception was for that specific purpose and which have a representative membership of the classes which are directly assisted by such specifications?

¶ Is it not a more sensible and practical procedure to concentrate all this superfluous brain work in an effort to disentangle and solve the Engineering Contractors' problems? To promulgate his welfare. To strive to attain an end that will make his burdens lighter. To draft and push through the legislatures by united effort equitable laws that will materially simplify his troubles. To combine forces and concentrate energy on evolving methods of efficiency in management, construction, cost-keeping and the many other things which will make the life of the Engineering Contractor not a gamble but a secure and remnuerative proposition in which effort and brains properly applied will always bring success. A business that will be as safe for the small Contractor as it is for the big powerful firm.

¶ This matter must be gone into carefully and thoroughly, must be considered from many angles and with unbiased fairness by a Committee representative of this Society. The Board of Direction, therefore, at its recent meeting appointed a Special Committee composed of the following men:

Edward Wegmann, Chairman,
Consulting Engineer.

Hillis F. Hackedorn,
President, Hackedorn Contracting Co.

Howard J. Cole,
Superintendent, P. J. Carlin Contracting Co.

William B. Bamford,
Consulting Engineer.

William Law Bowman,
Attorney-at-Law.

J. R. Wemlinger, Secretary.

¶ The above Special Committee is at present taking steps to revise Committee Work and expects to present its final report at the Annual Meeting of the Society in January, 1915. There is probably no work that will be of greater benefit to the Society than this Committee.

¶ All suggestions and comment on the above subject should be addressed to the Secretary at the Rooms of the Society, New York.

Contract Payments Based on Cost

By George I. Battelle

THE method of payment for heavy grading, as in railway work, where classification is the basis of settlement, has long been recognized as a makeshift and merely an attempt to base payment upon cost. This method results in more or less friction on almost all contracts, for there are generally some strata in a section of grading which, strictly speaking, may be classified underthe specifications as belonging to a formation which calls for a less payment than the actual cost of doing the work, with the result that the contractor justly feels that equity has not been done him in the matter. This condition obtains more generally than its reverse, wherein the work is thrown into a higher classification than that warranted by its cost and the contractor takes an excessive profit.

In some cases recourse is had to force-account as a means to obviate the above difficulties, but this means is usually undertaken on minor work, or if of any size, with a contractor in whom the engineer has confidence. Force-account work, however, lends itself too readily to the undue benefit of the contractor and is not generally resorted to except on small work coming up in connection with a large contract. Force account work is merely cost plus a certain percentage. Another method of contracting is cost plus a fixed sum. This has not been used in railroad work, but is merely mentioned as an attempt to make the interests of the two parties to the contract as nearly identical as possible when referred to the cost standard.

General usage, therefore, prescribes for railroad work a contract which is based on cost under the guise of geological segeration with numerous tests and conditions to be met as the determining actors in doubtful cases of classification. The interval wherein honest differences may wander is generally of a larger scope than should be allowed, but under the classification idea can not be escaped from.

In what follows will be presented a method that is definitely based upon the actual cost of doing the work with nearly all incentive to pile up the cost removed. Under this method it is to the interest of the contractor to keep the cost as low as possible, for the lower his cost the greater his percentage of profit and at the same time the less is the total amount he is paid, thus reaching ends desired by both parties to the contract.

There are two variations in the use of the method, the first of which is primarily adapted to railway work, while the second is applicable in all branches of construction.

FIRST APPLICATION

The first method would apply to a railway-grading contract of considerable extent wherein there are various graduations of strata differing in cost of handling. The procedure is as follows:

(1) Estimate as closely as possible the average unit cost of handling the major portion of the material.

(2) Establish an upper and a lower figure of which the average estimated in (1) is the mean with the upper figure twice as great as the lower; i. e., the upper figure is 4/3 the average in (1) and the lower figure 2/3 that average.

(3) For each section of the work the contractor is to get a unit price equal to the actual unit cost of that section plus one-half the difference between that cost and the upper figure established in (2); provided

(4) That the profits be not less than a certain minimum percentage or more than a certain maximum percentage established beforehand.

Should the bulk of the material be estimated to cost less than the remainder, the price schedule would be made an ascending one and a descending one if the reverse was the case. A table can then be easily prepared showing payments of increased percentage profits with decrease of cost below the estimated cost and decreased profits with increased cost.

For illustration, suppose the estimated cost of doing the bulk of the work under a certain grading contract to be 15 cents per cubic yard with the remainder of the work costing more. It is decided to allow a minimum profit of 10 per cent. and a maximum profit of 40 per cent. The price schedule under these conditions would be ascending one of 10 cents, 20 cents, 40 cents, 80 cents, $1.60, and Table I. shows the unit price to be paid, with its attendant profit, when the actual cost has been determined.

Thus if the actual cost is the same as estimated, i. e., 15 cents, the pay price would be 17½ cents, showing a profit of 16 2/3 per cent.; but if the actual cost be cut down to 13 cents, the contractor would be paid 16½ cents, but his profit would be 27 per cent. On the other hand, if the actual cost amounted to 17 cents, the payment of 18.7 cents would give him only a 10 per cent. profit, which profit would continue until the actual cost ran up to 22½ cents, when his profit would be 40 per cent. on that cost.

Under this method all variations in cost of handling the same geological formation under the different conditions in which it might be found or of uncovering and moving a formation not contemplated under the classification of the contract, would automatically bring its own payment and obviate all discussion with the engineer as to the justness of a higher classification, and the skill used by the contractor in meeting the different conditions would determine the size of his profit.

The jumps in the table between 11 and 11½ cents, 22 and 23 cents ,and 44 and 46 cents, correspond to, although they are not so great as, the variations of price under the usual classification contracts. It is near these points that the only incentive to increase cost exists and where the engineer in charge of the work would have to carefully watch the cost account of the contractor and be sure that he was neither lying down on him or trying to slip in outside costs in order to slightly raise his cost

TABLE I. PRICE SCHEDULE 10c, 20c, 40c, 80c, $1.60. MINIMUM PROFIT 10 PER CENT, MAXIMUM PROFIT 40 CENT.

Cost c.	Deduction from next highest price*	Pay Price c.	Profit c.	Profit %	Cost c.	Deduct* c.	Pay c.	Profit c.	Profit %	Cost c.	Deduct* c.	Pay c.	Profit c.	Profit %
					20	....	22.000	2.00	10	40	.....	44.00	4.00	10
					21	....	23.10	2.10	10	42	.....	46.20	4.20	10
10	....	11.000	1.000	10	22	....	24.20	2.20	10	44	.....	44.40	4.40	10
10½	....	11.550	1.05	10	23	8.50	31.50	8.50	36.96	46	17	63.00	17.00	36 96
11	....	12.100	1.10	10	24	8.00	32.00	8.00	33.33	48	16	64.00	16.00	33.33
11½	4.250	15.750	4.250	36.96	25	7.50	32.50	7.50	30.00	50	15	65.00	15.00	30.00
12	4.000	16.000	4.000	33.33	26	7.00	33.00	7.00	26.92	52	14	66.00	14.00	26.92
12½	3.750	16.250	3.750	30.00	27	6.50	33.50	6.50	24.07	54	13	67.00	13.00	24.07
13	3.500	16.500	3.500	26.92	28	6.00	34.00	6.00	21.44	56	12	68.00	12.00	21.44
13½	3.250	16.750	3.250	24.07	29	5.50	34.50	5.50	19.00	58	11	69.00	11.00	19.00
14	3.000	17.000	3.000	21.44	30	5.00	35.00	5.00	16.67	60	10	70.00	10.00	16.67
14½	2.750	17.250	2.750	19.00	31	4.50	35.50	4.50	14.52	62	9	71.00	9.00	14.52
15	2.500	17.500	2.500	16.67	32	4.00	36.00	4.00	12.50	64	8	72.00	8.00	12.50
15½	2.250	17.750	2.250	14.52	33	3.50	36.50	3.50	10.60	65	7	73.00	7.00	10.60
16	2.000	18.000	2.000	12.50	34	2.60	37.40	3.40	10	68	5·2	74.80	6.80	10
16½	1.750	18.250	1.750	10.60	35	1.50	38.50	3.50	10	70	3·0	77.00	7.00	10
17	1.300	18.700	1.700	10	36	0.40	39.60	3.60	10	72	0·80	79.20	7.20	10
17½	0.750	19.250	1.750	10	37	....	40.70	3.70	10	74	.....	81.40	7.40	10
18	0.200	19.800	1.800	10	38	....	41.80	3.80	10	76	.....	83.60	7.60	10
18½	....	20.350	1.850	10	39	....	42.90	3.90	10	78	.....	85.80	7.80	10
19	....	20.900	1.900	10										
19½	....	21.450	1.950	10										

*Equals one-half difference between cost and next highest price.

TABLE II

Suppose the price bid as the actual cost to be 12c and the minimum and maximum profits 5% and 30%; 16c would then be the figure to which the following table is built to fulfill the conditions:

Cost	8	8½	9	9½	10	10½	11	11½	12	12½	13
Pay	10.4	11 05	11.70	12 35	13	13 25	13.50	13.75	14	14 25	14 5
Profit	30%	30%	30%	30%	30%	26%	23%	19.6%	16.67	14%	10.46%
Cost	13½	14	14½	15	15⅓	16					
Pay	14.75	15	15.225	15.75	16 275	16.800					
Profit	9 26%	7%	5%	5%	5%	5%					

to that allowing the higher percentage. With a carefully estimated cost to which the price schedule is adjusted this contingency is quite remote.

In the measurement of volume to determine cost, individual cuts could be taken by themselves should the same method be taken of working them throughout, instead of measuring the volume of the different strata. Total yardage of a cut into total cost of removing it would point out its own payment and be an easier solution of the price to be paid than long bickering between engineer and contractor with a probable lawsuit showing on the horizon over difference in judgment as to the proper classification to be allowed for some certain yardage.

The variation of this cost method of payment referring to a single cost schedule where each figure therein is double its predecessor is applicable to any piece of large work composed of varying units, since in the railway grading for which it is written the cost of doing a unit portion widely varies by reason of uncontrollable conditions and may be anything between two extreme minimum and maximum prices.

SECOND APPLICATION.

The price schedule under this variation is determined as under the first and is applicable to all forms of construction, as well as railway work.

Using railway work for an example, instead of asking for a bid for which the contractor is willing to remove certain kinds of material, a bid is sought upon the eliminated cost of doing the work by different methods, i. e., by scrapers, by wheelers, by steam shovel and wagon, by steam shovel and cars, or by whatever method the contractor is equipped for and the situation is favorable to. The difference between the two applications lies in the fact that in the first the bid is based upon a rather hazy estimate of the different priced yardages to be handled which is often very misleading. In the second case the method of handling a closely known yardage is the basis of the bid, with each party sharing in the decreased cost if the estimated cost is found to be too large.

Corresponding to the figure bid for each of the different methods proposed for handling, a table of payments could be made by referring the actual cost of any certain yardage to a figure one-third larger than the bid and dividing this difference between both parties to the contract up to the points where the minimum and maximum percentage were reached, beyond which points their respective percentages would obtain on the actual cost of doing the work. This may be illustrated in Table II.

The second variation is merely a special case of the first. In the first, one price schedule is used throughout for all methods and final costs and is obtained by doubling each preceding figure to obtain the succeeding one; in the second, a single short table is made for each figure bid and though the cost may increase it never jumps into the next higher table, for the one table always applies to the method of handling upon which it was based.

Though the illustrations of both variations of the method are made by reference to railway grading, the second way lends itself very readily to concrete, steel, or brick work, timber framing, roadwork, pile-driving and in fact to all construction where payment is made upon the number of units of various kinds incorporated in the work.

Under the method the one letting the contract would have to be supplied with, a swell as check, all pay rolls, original bills of material, equipment rental, and stock rental, if not more, to the cost record on a contract as he now gives attention to the workmanship under it.

Among the advantages to be cited for this method of contracting may be mentioned:

The range of bidding on any one contract is larger than under the present, for in addition to the range of prices there is the variations in the minimum and maximum profits to be considered, for while two or more bidders might submit the same figure as to actual cost there might be some considerable difference as to the range between minimum and maximum profits that they would consider equitable.

As the contractor is guaranteed against loss each contract would give the contractor the profits on that contract and he would not be looking to make a succeeding contract stand the loss of a former. This is as it should be, for no matter what the conditions it is not fair to any of the parties concerned to carry a loss from one contract to another. Each contract would be required to meet the labor, material and weather conditions which exist during the completion of that contract. Unforeseen emergencies are provided for their actual cost instead of being figured as probable and the attempt made to provide therefore by tacking a lump sum upon the figure for which, under normal conditions, the contractor would be willing to undertake the work. It is not claimed for this method, however, that it leaves nothing to be desired, for under it the incentive would still exist to slur the workmanship in order to reduce the cost.

The contract being let at an estimated cost which carries with it a payment allowing a fair profit and the one letting the contract sharing in any saving or decrease in cost, he cannot in justness feel that the contractor has the best of it if the contractor makes a larger percentage profit, inasmuch as the latter would receive a total sum less than the estimated total. The method is not at all complicated, but is essentially a sliding-scale payment which readily fits into present practice of cost keeping and competitive bidding.—*Engineering News*

Lack of Care in Preparing Bids

While lack of careful investigation of the actual conditions to be confronted on the work is a failing that is altogether too common with many contractors, the careless way in which bidding has been done of late on sewer construction in outlying districts has been made the subject for a special warning by the Los Angeles board of public works. In the older districts, where underground work has been conducted for many years, even the most careless bidder has some general information to go by that will tell him about what he may expect to meet when he actually gets to work. But in the newer districts the condition of the material below ground, and the water conditions, are not as well known. Too many contracts in these sections have been taken of late without proper investigation, the successful bidder finding out afterwards that the presence of water not anticipated has raised his cost far above what he had expected.

"Bidders for sewer work proposed south of Slauson Ave. should use more care in submitting bids as it is probable that underground water will be encountered over this district," is the warning given by the public works board. This might also be applied to districts west of the city where in some sections the presence of underground water, frequently in large quantities, is proving a costly item.

The lack of proper investigation before submitting bids is without doubt one of the causes for the wholesale offering of astonishingly low bids on much public work of late, and this condition cannot be attributed entirely to the anxiety of many contractors to land a job.

While it is unquestionably not right to award a contract to the lowest bidder when it is morally certain his bid is far too low, what may be done to correct the evil of too low bidding, is not clear. It has been suggested in the east that the rule be changed and the award be made not to the lowest bidder, but to the second lowest in all cases. The problem is one meriting discussion by contractors' organizations as well as architects, engineers and public officials. Certainly a better method than that in vogue at present could be devised.—*Southwest Contractor.*

Fixing a Forfeiture for Failing to Bid

Many and varied are the schemes promulgated of late affecting the ability of contractors to secure plans and specifications for work up for bids. Some of these plans are obviously unfair to the contractor, such as making him purchase the plans outright—frequently at a greatly exaggerated sum compared with the actual cost of the plans. This has been denounced by the contractors, and rightly, too.

The board of trustees of the Alhambra high school has however inaugurated a new scheme designed to prevent a growing practice that is without doubt unfair both to the owner and the other contractors who really want to submit a bid but are sometimes unable to do so because they cannot secure a set of the plans. The device adopted at Alhambra, which is now calling to erect three more high school buildings, is to require a deposit of $25 from the contractor who secures a set of plans, this deposit to be forfeited to the school trustees in the event that the contractor fails to submit a bona fide bid. This deposit is in addition to a deposit of $10 to guarantee the return of the plans, and in addition also to the 5 per cent. check or bond asked as a guarantee that he will enter into a contract if his bid should be the lowest responsible tender.

In other words, the person, be he contractor or some one simply curious to go over the plans, must put up $25 and donate it to the school board if he does not offer a bona fide proposal. This is fair enough to the contractor who seriously intends to put in a bid, and it is also a safeguard to the school board against the half-hearted contractor who does not know whether he wants to bid or not, but whose possession of a set of the plans may prevent the board from getting a real bid from another owing to there not being a sufficient number of plans available for all applicants.

There are not a great many building contracts offered at present and the contractors are keen for an opportunity to bid upon the work that is going ahead. This is shown by the large number of applications for plans. It is therefore obviously unfair for a contractor to secure a set of plans and then fail to submit a bona fide bid, thus probably preventing another from availing himself at the opportuity to figure the work. Furnishing such a large number of plans as is demanded now is also proving costly to an owner who desires to give everyone an opportunity to bid for the work but the plan devised by the Alhambra school board should accomplish the good results for which it is intended. The plan is unique—all the more in that it is eminently fair to both sides.— *Southwest. Contractor.*

Notes on Trench Sheeting

Unit Costs and Other Data Relative to Placing and Removing Wood, Steel and Mixed Bracing, Solid and Separately Spaced

By Richard T. Dana,* Consulting Engineer, New York City

TRENCHING methods and costs, by hand and steam shovel, were discussed by the writer in the "Engineering Record" of May 23, page 581. The studies on which the discussion was based also covered the details of trench sheeting and pipe laying. This article will deal with trench sheeting and a later one will treat of pipe laying.

For sheeting the trenches under consideration excavated by the steam shovel, Wemlinger sheet steel piling, section 2a, No. 12 gage, was purchased, the intention being to drive the sheeting ahead of the shovel with a McKiernan hammer, and excavate on the inside. As the operation of the shovel was not economical this plan was abandoned and the sheet piling was used in the hand dug trenches together with the lumber purchased for that purpose.

Extensible steel trench braces were chiefly used, but sometimes wooden braces either cut from the woods or made of broken ranges were employed.

The cost of sheeting the sides of a trench per linear foot depends on (1) the closeness of the sheeting, that is, whether the sections or planks are driven close together or spaced varying distances apart; (2) the skill of the workmen; (3) the urgency of the work; (4) the hardness of the material; (5) the depth driven; (6) the method of driving; (7) the kind of sheeting, whether wooden or metal, and (8) the kind of bracing.

In cases of badly caving banks or running sand absolute continuity of sheeting is necessary, but where the banks are firm, even though the trench be deep, the sheeting need only be used as a safety measure and the sections placed 3 ft. or more apart.

The most intelligent men should be chosen for the sheeting, as a single bad cave-in may wipe out the profit on a job and cause serious injury or loss of life. The head sheeter should be an active man, while his helper should be a heavy, strong laborer. Their pay should be greater than the pick and shovel men. In trenches of this character the sheeters are seldom worked to their full capacity, as work of this kind requires a certain minimum number of men and their day's work depends on the performance of the rest of the gang. Therefore, the costs given in the tables do not, in most cases, truly represent the minimum cost.

Where the material is hard and strong metal sheeting penetrates more readily than wood, and in running sand or water, the lap and clips on the metal sheeting make it very efficient in keeping the trench clear. However, the first cost is greater and on work of short duration it is not economical, unless the sheets can be used on another convenient job or sold advantageously. The weight of a square foot of this section is 7½ lbs., which makes it more difficult to handle than the wood planking 2 in. thick, which weighs about 5 lbs. per square foot. Steel extension braces are invariably more economical than wooden braces when the trench is narrow. The cost of placing them is much less. Wooden braces require measuring, sawing and wedging, while the same jacks may be used on several different widths of trench.

Some thirty sets of observations were made and separated into two classes, close and spaced, each of these being divided into three classes, mixed, wood and metal, for sometimes the wood and metal sheeting were used in the same trench as they came to hand. The rate of pay for sheeters was about $2.50 and that of the helpers about $2. Other labor received about $1.65. Overhead charges have been taken account of by including one-eighth the pay of foremen and waterboy, which were $4 and $1 per day respectively.

Cases 7, 8 and 9 give the cost of removing the sheeting. Case 9 is peculiar. This occurred in sheeting a trench through loose sand in which a 42-in. concrete sewer was to be laid. The metal sheeting was driven about 6 in. below the bottom of the trench and after being oiled was used as the outside forms for the concrete sewer. When the concrete had set and the trench has been backfilled within 2 ft. of the top the sheeting was withdrawn. A large wooden tripod with a differential block and tackle operated by two men had to be used for pulling the sheets. The average time for pulling one sheet on the day the third observation was made was 9 min. 52.3 sec., made up of the following items:

TABLE 1—SHEETING TRENCH—UNIT COSTS AND OTHER DATA, FOR WOOD, METAL AND MIXED SHEETING, WHEN SOLID AND WHEN SEPARATELY SPACED.

No. Obs.	Unit cost, cents Lin.ft.	Unit cost, cents sq. ft.	Trench depth, ft.	No. men	Equivalent 10-hr. performance, lin. ft. of trench	Remarks
Case 1—Mixed Sheeting, Solid.						
1	7.23	0.344	12	3	91	Sandy
2	8.00	0.620	6.5	4	100	Material caves badly
3	8.30	0.670	6.5	4	100	Clay and sand
4	8.61	0.480	3	2	60	Soil, poor sand
5	9.50	0.530	[illegible]	2	55.7	Soil, poor sand
6	10.50	0.704	7.5	4	80	Soil, clay gravel
Average	8.69	0.515	8.42	3	81.1	
Case 2—Wood Sheeting, Solid.						
1	7.80	0.390	10	3	98	Material sandy
2	8.00	0.450	9	2½	67	Clay material, some sand
3	8.55	0.710	6	3	75	Clay gravel
4	14.80	0.930	8	3	63.3	Very sandy; sheeting 8 ft. x 8 in. x 2 in.
5	14.90	0.530	14	2	36	Soil, a poor sand
6	19.50	1.150	8.5	3	31.4	Soil, sandy
Average	12.42	0.672	9.25	2.7	61.8	
Case 3—Metal Sheeting, Solid.						
1	9.10	0.350	10	2	62.5	Soil very sandy
2	9.40	0.360	13	2	61	Soil very sandy
3	9.60	0.368	13	2	60	Soil very sandy
4	11.00	0.610	[illegible]	3	70	Soil good sand
5	16.00	0.755	11	3	44	Soil sandy
6	18.50	1.020	9	4	54	Sand tending to cave in
7	22.40	1.250	9	3	37½	Good sand
8	24.30	1.520	8	3	38½	Very sandy, caving
Average	15.0	0.652	11.5	2.7	53.4	
Case 4—Mixed Sheeting, Separately Spaced.						
1	4.78	0.240	10	2	125	Soil a poor sand
2	6.54	0.356	9	4	100	Soil clay and gravel
Average	5.66	0.298	9.5	3	112½	
Case 5—Wood Sheeting, Separately Spaced.						
1	4.20	0.320	6.5	2	88½	Sections spaced 3 to 6 ft. apart
2	4.40	0.241	9	2	129	Soil poor sand
3	5.20	0.290	9	2	15	
Average	4.60	0.280	8.17	2	94.2	
Case 6—Metal Sheeting, Separately Spaced.						
1	1.90	0.150	6.5	2	194	Sections far apart
2	3.10	0.195	8	2	162	Sections far apart, clay and sand
3	3.12	0.169	9.3	2	180	Sections far apart, clay and sand
4	4.06	0.232	9	2	137	Sections far apart, clay and sand
Average	3.04	0.184	8.25	2	168	

TABLE 2—REMOVING SHEETING—UNIT COSTS AND OTHER DATA FOR WOOD AND STEEL SHEETING, SOLID.

No. Obs.	Unit cost, cents Lin ft.	Unit cost, cents sq. ft.	Trench depth, ft.	No. men	Equivalent 10-hr. performance, lin. ft. of trench	Remarks
Case 7.						
1	0.32	0.042	6.5	2	11.61	Wooden, spaced 3 to 6 ft. apart.
Case 8.						
1	1.1	0.042	13	2	3.00	Wooden sheeting blocked partly with wood and partly by jacks. Sheeting, solid. Soil a clay and poor sand. In unit costs given only direct labor is taken account of, i. e., foreman and waterboy are not included.
2	1.6	0.062	13	2	2.50	
3	2.2	0.084	13	2	1.50	
4	2.5	0.096	13	2	1.66	
5	2.6	0.100	13	4	2.50	
6	2.7	0.135	10	2	1.25	
7	2.7	0.135	10	4	2.50	
8	2.8	0.140	10	2	1.25	
9	3.3	0.137	12	4	2.00	
10	3.5	0.175	10	2	1.08	
11	3.6	0.180	10	2	0.94	
12	3.9	0.177	11	2	0.83	
Average	2.7	0.118	11.5	2½	1.75	
Case 9.						
1	5.6	0.311	9	2	0.70	Sheeting, steel, filled in to a depth of about 6 ft. before pulling. Used a differential block and tackle. Overhead charges, ⅛ foreman and ⅛ waterboy included.
2	12.5	0.695	9	2	0.31½	
3	12.9	0.718	9	2	0.30	
Average	10.3	0.572	9	2	0.44	

*Member of the Society

Item	Min.	Sec.
Loosening with mallet		18.6
Moving along chain hoist		40.0
Lowering hook and chain on hoist		43
Placing hook on sheeting and starting to pull	1	14
Raising sheeting	5	30.5
Removing hook from sheeting and putting sheeting aside		44
Miscellaneous		43.2
Total	9	53.3

2 laborers, at $1.65	$3.30
⅛ foreman, at $4	.50
⅛ waterboy, at $1	.13
Total cost per day	$3.93

Cost per linear foot (30.4 ft. removed), 12.9 cents.

Sheeting being on both sides of the trench and two pieces of sheeting being equal to 1 ft. of trench, the time per foot of trench was 19 min. 46.6 sec.

The number of feet of trench from which the sheeting was removed per day was about 30.4. The cost was as follows:

In case 8 the foreman and waterboy are not charged. If this were done the average cost would be about 3.2 cents.

At the beginning of the season 400 pieces of Wemlinger piling 10 ft. long and about 5,000 ft. b. m. of 2 x 8-in. longleaf yellow pine were purchased. The steel piling cost 28 cents per superficial foot, and the lumber cost about $34 per thousand. This does not include the timber rangers which were used for both steel and timber sheeting.

At the end of the season there remained 1½ dozen planks and some 20 ranges, all of the Wemlinger piling and all of the iron braces. The timber had been stolen, broken, burnt or otherwise wasted or in a few cases used for other purposes. During the summer the steel sheeting was repeatedly used for roadways in and out of sand pits and whenever the hauling was bad. During the fall and winter it was used to heat the concrete for the buildings under construction, the sections being laid at an angle of 30 deg. so that one end rested on the ground and the other on a wall of building blocks or bricks. Some of the wooden sheeting was used as fuel. The steel sheeting, in spite of hard usage, remained in fit condition to be used many times and in fact seemed almost indestructible.—*Engineering Record.*

Daily Conferences of Contractors on Rush Work

The Statler Hotel, Cleveland, which was recently completed on a rush order by James L. Stuart, Contracting Engineer, Pittsburgh, presented many interesting features of construction and administration. One of the many practices which helped very much to expedite the work and "iron out all the difficulties" was a daily meeting of all the sub-contractors on the work together with architects' representatives and others interested in the building. At these daily meetings each trade was taken up separately with the principal representative of that particular trade and the representatives of all the other trades present. He was asked regarding the progress of his work and was told to state whether or not he was being retarded by any of the other trades. If it was found that he was being hampered he was made to state explicitly to what extent and how. Then the matter was promptly adjusted. A typewritten report of each meeting was posted up on the general bulletin board so that each of the sub-contractors would have access to it the following day.

—*Engineering and Contracting.*

Some Abuses Practiced by Contractors in Handling Men

THE contracting game is played with men, machinery and capital; but the labor side, that dealing with men, is the most uncertain factor. It is a great problem and one that a contractor must face and solve. In some respects each contractor must decide matters for himself; but the results he obtains will be influenced to some extent by the acts and decisions of other contractors, over the entire country, and more especially those in his immediate locality. In other words there should be some co-operation and the dissemination of certain principles and ideas that will be of assistance to all. Then too, whenever possible, regulations should be set that can be followed; for this problem of labor is a national one, and effects every community.

Many abuses in the handling of contractors' workmen have already been commented upon, but it may be well to list the dozen or more evils that exist, so as to show what remedy should be applied and how.

1. The deceiving of men when employing them is one evil that may have but little effect on a particular contractor or a special job, but in a general way it has a far reaching effect on the labor market and on the men themselves, and finally the harm comes back onto contractors.

If men are deceived as to the conditions under which they may have to work and live, or as to their laboring hours or pay, they are not only dissatisfied, but they will do indifferent work and take the first opportunity of leaving the job that occurs, although they may go to work where conditions are worse; but they are satisfied, for they have not been deceived as to the second job. The common laborer is not only suspicious, but he is also resentful, and he feels that in most cases employers are getting from him more than their just dues. Have men told the true conditions, the hours of work and the rates of pay and then see to it they get all that has been promised them.

Workmen are often deceived as to the length of a job. The deceit in this case may be intentional or unintentional, but the results are the same. A contractor who knows he needs men for a few days only or for any short period, and engages a body of men, or carries them a long distance to his job, without telling them of the probable length of service, works a hardship upon many of these men, and causes himself to be injured by helping to spread dissatisfaction among his regular forces, and making it more difficult to obtain laborers when he needs them. Men who are to be used to break a strike should be told so.

Unintentional deceit may be caused by newspaper reports and rumors about a job, so that the men may deceive themselves; but the reflection comes back onto the contractor and employer. During the past year a prominent manufacturer announced a profit-sharing plan with his employes, and made a public statement that he would establish a minimum wage (setting a fairly high figure) in his plant, all coupled with the statement that there was no scarcity of work. This was published by nearly every newspaper in the country, so that a tide of unemployed swept towards his factory, until the city in which it was located was filled with thousands and thousands of unemployed, and the authorities had to take steps to stop the influx, and were taxed to the utmost to care for those already on their hands. This was an injury to the labor market, the bad effect of which will be far-reaching, and its influence will be felt for a long time. The writer has seen the same thing occur in starting a new piece of construction of some magnitude, but even then the conditions of things were not affected as much as in the case just cited.

2. Labor agents often deceive men in sending them to jobs. Their interest ceases when the contractor takes charge of the men and their own fees are paid, but the contractor must bear the injury done. Thus it is well to have some one advise the men of the conditions before leaving the labor agent's office.

Many other abuses caused by labor agents have already been commented upon. The writer believes in labor agents, and he knows there are good men in this business, and that some have been highly successful in furnishing contractors with a good class of workmen; but like any line of business there are men who, if permitted in it, should be controlled by the proper laws and inspection. There should not only be state and national regulation, but very rigid inspection. It is to be hoped that the present national commission just organized by an act of congress will be an aid in this matter. Any regulation and inspection will be opposed by the irresponsible and rascally agents, while those who are attempting to run their business on the proper principles will welcome it.

Inasmuch as so many abuses have been practiced by labor agents in some of the larger cities, and especially New York, some of the most prominent business men and social reformers have organized employment bureaus in order to have both employes and employers treated fairly. These agencies are not run for profit, but to do a fair business and only to cover actual expenses.

3. Insanitary and poorly-arranged camps are a great hardship to those who must live in them. The effect is that men give poor work to their employers and soon become dissatisfied and leave the camp. The arrangement of camps and keeping them in sanitary condition has been dealt with by the writer in a chapter, in "The Economics of Contracting," so it is not necessary to go into that phase of the question here.

Every camp, though, should have in it some means of recreation for the men, so that they can not only live comfortably in the camp, but also enjoy and amuse themselves in their spare time. The money so spent will be found to pay well, in holding men on the job, and also in the better work that they will do, and the interest they will have in their employer's work.

4. The author remembers working in a contractor's camp in the Rocky Mountains some years ago, where tough beef, boiled beans, bread and coffee were served three times a day. Once in a while boiled rice and raisins or some dried fruit were served with some sweetened dough as cake, and this was the fare week after week, except that about once a month a few bushels of onions were brought to the camp. Both Americans and Mexicans went wild over these and many of the onions were consumed raw, before there was an opportunity to serve them on the table. A canned sardine or a piece of cheese would have

been considered a luxury in this camp. This is an example of a poor and limited variety of food, and the cook became so careless that it was with difficulty that most of the men at the tables ate their meals. No excuse could be offered for serving such meals, for other contractors on the job were feeding their men much better.

Men to do hard work must be furnished with plenty of good, wholesome food, and it should be well prepared and served cleanly and nicely. Fancy foods are not necessary, but there should be some variety, and to-day there are only exceptional locations where it is not possible for contractors to obtain a fair variety of goods. The indifference shown in feeding men quickly reacts in men showing indifference in their work, and nothing drives men to the saloon quicker than poorly prepared and insufficient food. A contractor who may feed his horse well, may care little regarding how his men are fed. The writer has had much experience in feeding men, and he has learned that 50 cents judiciously spent in pleasing men as to their meals, quickly returns a dollar in their work.

5. Disorder on construction work and in camps is an evil that means that any job will be disorganized and the men and foremen, instead of working together, will be interfering with one another, thus preventing others from doing good work. Discord will break up any system, and the contractor is the one to suffer and pay the cost. Thus it becomes him to see that drinking, fighting, gambling and other immoral influences are cut out entirely. Start a job right in this respect and it is very easy to carry it along in the same manner; but once let the tough element among the men gain an ascendency and it will be difficult to stop them. Many contractors, besides losing money by allowing disorder on their jobs, have also lost their lives, being killed by some lawless laborer or foreman.

Men should never be allowed to have firearms in a camp and it is even poor practice to have foremen swaggering around with pistols in their hip-pockets, drawing them on the workmen and placing themselves in such a position that they must either shoot or be known as pistol bluffers. If men are to have shot guns or rifles for hunting, they should be made to keep them in the contractor's office and be allowed to use them only when they have opportunity to hunt. The practice of raffling off pistols and guns to workmen in order to make large sums of money from the men is to be condemned, as it may lead to danger and it is not fair to rob the men of their money. This is mentioned because the writer has seen many pistols and guns sold in this manner, $25 to $50 being obtained for an article that was hardly worth $5.00.

6. The evil of the drink habit and the saloon need only be mentioned for it has already been discussed at some length. A contractor, though, who is an habitual or excessive drinker need only expect that most of his men will follow him in drinking. It is not necessary to have liquor on a job for personal use, under the guise of furnishing a drink to the engineer when he visits the work.

7. Commissaries on jobs outside of cities and towns, are, in the opinion of the writer, necessary. On such goods as are sold in these commissaries—and there should be such a variety as to furnish the many needs of the men and their families—a fair profit should be made by the contractor, a profit equal to that of any storekeeper; but the excessive prices charged not only are a hardship on the men, but prevent them from buying many things that would be purchased if the prices were reasonable. Thus the contractor is likely to make less profit with the excessive prices than by selling a greater bulk of goods at reasonable prices.

8. Defrauding men in their time is an evil that injures not only the workman but also the contractor; for the money thus stolen is likely to be only a small part of that which must be spent to obtain others in their place. Men should be given the actual time they make, and whenever possible some system of time keeping and recording should be used that will allow the men to know the time they are credited with each day. Then disputes as to errors can be settled promptly while the matter is fresh in the minds of all those concerned.

In like manner charges made against the workmen for rent, goods purchased and similar things should be so kept that the workmen know the amount as well as the contractor. Then and only then will the workmen know beforehand the amount of money they are to receive on pay day, and receiving that amount they will be satisfied.

9. The defrauding of the laborer of his hire on pay day is not practiced as it once was; but enough is still done in this line to make laborers very suspicious of some contractor's pay days. A contractor who makes a practice of robbing his men, or allowing them to be robbed in his name, need only expect that his men will rob him to get even. If they cannot do it in any other way, they will soldier on him at their work, and when they are tired of loafing for little pay, they will go off to work for some contractor who will pay them for the work they do.

10. An evil that contractors have to contend with is the roaming habit of a large percentage of laborers. This is an evil in which contractors are perhaps more sinned against than sinning, for they themselves must roam a great deal to keep themselves in work, and thus their laborers form the same habit. But contractors allow foremen to discharge men too quickly in many cases. A man discharged on construction work must move on. Discharged again, there is another move; so that in this way men who could be made to earn money for a contractor are turned into roamers, and the habit may become so fixed with them that they become tramps.

A man should be discharged for insubordination as an example, and in order that a foreman's orders should be obeyed and respected; but the indiscriminate discharging of men is wrong. A man shoveling may not be able to keep up with his mates, yet he may be an excellent man with a pick or on the dump. Or a man in a concrete gang may not be good with a barrow, but may do efficient work on the forms. Foremen forget their own functions when they do not use their heads to secure work from men, and only discharge them when they are not able to keep up or do not do the work in a satisfactory manner. Men are frequently more difficult to obtain than foremen, yet they are run away from some jobs by the last named as though they could be obtained from the surrounding bushes. Men must often be taught the proper motions of certain work, and if once shown will hold up their end. Others must be spurred on by encouragement and others made to understand that they must put forth their best efforts. Foremen are to make men work and not discharge them.

11. Many contractors show an entire lack of interest in their men. Some one contractor carrying on large operations, to the writer: "I never know a workman on any of my jobs and I never want to know them."

It is such men as this that bring injury to any business. They are willing to take out of the business all they can get, but it never occurs to them that they owe something to their business and their employe.

Every employer, no matter in what line of business he is engaged, should show some interest in his employes, who are assisting him in making a living. This does not mean that he must become intimate or familiar with them, but each man should be treated with some consideration and as though he was an individual who was worth having.

No employer should so hold himself above his men that any workman cannot see him if occasion warrants it.

12. It is a wrong principle to allow others to make a living off a contractor's workmen. In the west it is a common practice to allow a boarding contractor to make a living out of boarding contractor's workmen. In the east padrones become rich in furnishing men, and either boarding them or furnishing them with supplies. In some cities labor agents are allowed to prey upon laborers. In other localities storekeepers get contracts for furnishing men with supplies, only to charge them exorbitant prices.

The contractor himself should control these things, for not only will the men be treated better, but he himself will add to his profits.—*The Contractor.*

Book on Contracting and Lien Law

There has recently been published by Bender & Co., of Albany, N. Y., a book on the "Law of Mechanics' Liens and General Contracting," by Thomas H. Ray, of the New York City Bar, a member of this Society.

The work is in two parts. The first treats of the law of contracts with particular reference to the rights and liabilities of contractors, builders, architects and engineers, etc., in both public and private contracting work; and contains chapters upon the following topics: Formation of Contracts; Performance in General; Security for Performance; Time of Performance; Certificates and Arbitration; Extra Work and Specifications; Miscellaneous Provisions.

Part II is devoted to a thoroughly complete treatment and discussion of the New York Law of Mechanics' Liens, and includes the following subjects:—Definition and Construction of Statute; Acquisition of Lien; Proceedings Necessary to Perfect Lien; Operation and Effect of Lien; Liens Upon Public Improvements and Railroads; Enforcement of Liens; Pleading and Practice; Assignment of Lien and Contracts, together with a complete set of forms.

The work is replete with authorities, it being the evident preference of the author wherever possible to support his expressed opinions by the citation of authoritative precedents in which similar questions have been decided. And the New York Law Journal in reviewing the book recently expressed the opinion that every New York case bearing upon the subjects discussed had been cited.

While it is a practical law book for lawyers this work should prove of great value to all persons interested in Contracting and Building Law. The volume contains upward of 700 pages, so arranged that ready reference may be made to the topics in interest.

Delay in Awarding Contracts

Delay in taking final action on a contract after the bids have been received oftentimes works a hardship on the low bidder. The contractor has bid on the undertaking in good faith and has deposited his certified check or other security as a guaranty that if successful he will execute a satisfactory contract and furnish bond for the performance of the work. He is thus in a measure tied down. If his outfit is not large enough to handle more than one piece of work he hesitates to bid on other undertakings because he does not know whether or not his equipment will be required for carrying out the first contract. This contractor is in about as aggravating a position as the fisherman whose tackle gets caught in an overhanging tree just when the fish are beginning to bite briskly. His companions are having rare sport, while he, red of face and with hands trembling with excitement, is striving to untangle his line from the branches. Delays of a month in awarding a contract or rejecting the bids are of frequent occurrence. There have been instances where bids have been held under advisement for six months or even longer before final action was taken. In many cases the delay is due to some unforeseen happening, such as a court action brought by a taxpayer. In other cases, however, there is no such excuse. Right of way difficulties, that could have been settled before the call for bids was issued, often hold up the awarding of a contract. The settlement of legal troubles after the bids have been taken instead of before the work is advertised, is another cause of delay. Some cities or public organizations are notably slow in awarding their contracts. They have so much red tape, so many checks and counter checks that the low bidder can take a good long vacation while waiting to find out whether his bid is accepted or rejected. On the other hand it is becoming quite common to specify in the official proposal or the form of contract that the work will be awarded or the bids rejected within a certain definite time. A contractor bidding under this condition knows just what to expect and can make his plans accordingly.—Engineering & Contg.

Engineering Law

Conditions as to Time of Performance of Contracts

By Thomas H. Ray,* of the New York City Bar

A GUARANTEE by a contractor that his work will be completed within a specified time is often one of the inducing causes of his employment by the owner. Suppose such a provision is incorporated in a contract, and the contractor fails to perform within the agreed time. What redress has the owner? Suppose the owner, or one of his sub-contractors, or the law delays the work. What redress has the contractor? Or suppose no time for the completion of the work is agreed upon. How long must the owner wait upon a dilatory contractor to perform, before the law will permit him to say that patience has ceased to be a virtue?

Reasonable Time.

The owner of a valuable piece of New York City real estate recently agreed to erect a building thereon. Two others agreed to lease it for a period of twenty years. From the date of the contract the lessees were to make payments of $2,500.00 per month which were to be returned to them when they executed a proper lease with sufficient security, but which payments to the extent of $60,000.00 were to be retained by the owner upon the lessees' default. The contract was silent as to the time when the building was to be completed. The owner made a contract with the construction company of which one of the lessees was president to erect and complete the building in July, 1907. In February, 1908, the building was still unfinished, and the lessees attempted to cancel the contract, because of the delay and demanded repayment of the amounts paid by them to the owner. They failed to serve any previous notice on the owner that he must complete the building within a reasonable time and that if he did not do so they would rescind the contract. The court held that their failure to do so was fatal to their cause of action against the owner. The law is that where no time is specified in a contract for its completion that it must be completed within a reasonable time, but neither party can put the other in default without first serving a notice demanding that the work be completed within such reasonable time. What is a reasonable time is a question of fact, depending upon the circumstances in each case. Where the facts are disputed the question must be answered by a jury.

Notice to Begin Work.

It is often provided that a contract must be completed within a specified length of time, without fixing any date for the commencement of the work. In such a case the time does not commence to run until a notice is served upon the contractor directing him to begin work, even though he enter upon the performance of the work before receiving such notice.

If a contractor agrees to erect a building for the city to be completed in three months, work to be commenced at the time designated by the commissioner in charge, before the contractor can be said to have neglected to enter upon the performance of the contract, the commissioner must designate a day upon which work is to be commenced.

But no particular form of notice is necessary provided the intention to start the time of performance running is made clear. So where a contract was awarded by the City of New York for the construction of a school to be completed within 300 days and the superintendent of buildings wrote to the contractor saying that the contract had been approved by the comptroller and that "there need be no delay in the progress of the work" the court decided that no further notice was necessary.

Specified Time—Liquidated Damages.

In constructive work "time" is usually so important an element that a date is fixed before which the work must be completed, and a clause is incorporated in the contract to the effect that the contractor shall pay to the owner a stipulated amount for each day of delay thereafter. The theory is that it may be impossible to determine with exactness the damages resulting from the delay and therefore the courts have recognized the right to the parties to fix the damages in advance with the limitation that the amount thereof shall not be so disproportionate to the actual damages as to amount to a penalty. Each case must be decided upon the consideration of all of the circumstances involved, for while the object of such provisions is to induce prompt performance, they have been known to be conductive to delay. Such was the case where on a large public contract job the contractor had enclosed his work with a fence plastered with advertisements. The work was all but completed yet the contractor for unaccountable reasons refused to conclude it and seemed to look with serenity upon the payment of his daily sum of fixed damages. The mystery was solved to the satisfaction of the city officials when they learned that the contractor's daily income from the "billboards" was just double the amount of the liquidated damages.

Delay Excused.

It may well be however that the contractor's failure to perform in the specified time has been caused by the owner himself. If such be the case the contractor's time to perform is extended a reasonable time beyond the date fixed and the provision for the payment of damages is abrogated, because liquidated damages cannot be apportioned. The power may be given to the architect or other supervisor of the work to grant an extension of time and fix a new date for performance in case of delay caused by the owner and in such case both the time and damage clause may be preserved. It should be noted that where delay is caused by the owner, the contractor's time is not extended merely for a time equal to the length of delay, because that might not be sufficient. It is very plain that if a contractor has his men and tools on hand and has arranged for the delivery of the necessary material that a sudden break in the work may frustrate his entire plan. The contractor must then rearrange his campaign for the work. Allowance must be made for this fact. The contractor's time must therefore be extended a reasonable time considering all of these facts and the reasonable time may be much greater than the length of the delay.

It was thus held where the Callanan Company agreed to pave a street for the Village of Oneonta. The contractor agreed to furnish all necessary material and labor with the exception of the curbing which was to be furnished by the village. The work was to be finished by a certain date and on the contractor's default he was made liable to pay damages at the rate of Fifty ($50.00) Dollars per day. The Village did not furnish the necessary curbing, and the contractor was therefore unable to pro-

*Member of the Society.

ceed with the work. The provision for liquidated damages was held to be abrogated because the contractor's work was not only delayed but made impossible, and his time for performance was extended a reasonable time after the necessary material was delivered to him.

Delays for which the owner may be held responsible and which may be held to excuse the contractor's punctual performance may be grouped under the headings here given.

(a)

By Request of Owner.

Where one party to a contract requests delay he cannot of course defend against the other because his request is granted to him. Thus where one Davey agreed to deliver to Pitt 5,000 bbls. of cement at the rate of 250 bbls. per week. After the first delivery Pitt gave notice that no further deliveries were to be made until called for. Thereafter he demanded that the delivery should be promptly made and Davey was unable to do so, because he was unable to secure the necessary supply from the manufacturer. Pitt sought to recover the extra cost to which he was put by purchasing elsewhere. Recovery was denied him because the first delay was at his own request and that resulted in the defendant's inability to subsequently carry out his contract properly.

(b)

Failure to Perform Conditions Precedent.

In cases like the Callanan case mentioned above where the owner agrees to supply necessary material it is of course impossible for the contractor to proceed if the owner is himself in default. Likewise in the case where the contractor agrees to erect a building and it is necessary that the owner should secure a permit from the Municipal Building Department before the work can proceed, or in a case where the owner refused to allow the contractor to take possession of the property in order to perform, the contractor's delay is excused. In either case the failure on the part of the owner to carry out his part of the agreement which makes it possible for the contractor to proceed is sufficient cause for excusing the contractor and extending his time reasonably beyond the fixed date.

(c)

By Other Contractors.

It frequently happens that where a work is parcelled out to a number of independent contractors that the work of one may be delayed by the failure of another to perform promptly. In such a case the delay is excused because the owner is responsible for the failure of the contractors whom he employs. And this is so even though some of the work is held up, which is not delayed by the other contractor, provided the entire job is finished as soon as opportunity is given.

(d)

Failure of Payments.

It is customary in construction contracts to provide for partial payments to be made as the work progresses. In these cases the duties of the parties to each other alternate. First, the contractor must perform a certain part of the work. The owner is then obliged to make a partial payment. So it continues until the entire work is completed. If, therefore, the owner refuses to make a partial payment when it is due and the contractor is for that reason unable to proceed with the work the contractor's delay is excused.

(e)

By Operation of Law.

A contractor, Dady, agreed to grade a street for the city, the work to be done within a certain time. There was a law which gave sewer work precedence over all other work and most of the contractor's delay in grading was due to the fact that a sewer was being built, and the contractor on the sewer work under the law had the right to proceed even though in so doing he delayed the work of Dady. When the contractor demanded his money the city sought to charge him liquidated damages at the rate of twenty ($20.00) Dollars per day for the delay. The court held that such a position on the part of the city was untenable and that the city could not avail itself of the right to delay the contractor's work under a statute and then charge him for the delay so occasioned.

(f)

Unusual Circumstances.

If the contractor seeks to avoid the liability for delay in the performance of his contract because of "strikes," "boycotts" or meeting with unforeseen difficulties, he must so provide in his contract. But even where such a provision is made in the contract it is his duty to use every possible means within his power to perform on time and unless he does so the delay is not excused.

Waiver of Forfeiture.

Where there is a provision in the contract requiring the contractor to perform within a specified time on the failure of the contractor to do so ordinarily two courses are open to the owner. He may either permit the contractor to continue and complete the work and hold him liable for the damages occasioned by the delay whether such damages are the actual damages or liquidated damages; or he may elect to declare the contract forfeited and rescind it.

But if the owner allows the contractor to continue the work he cannot defend an actions brought by the contractor for the amount due him under the contract on the ground that it has not been performed within the specified time but he must counterclaim against the amount due the contractor for the damages which he has incurred. In other words by allowing the contractor to continue after the specified time the owner waives his right to the forfeiture of the contract but does not waive his right to the damages which he has sustained.

Ejectment of Contractor.

It is customary to provide in improvement contracts a provision giving to the owner the right when the contractor fails to proceed diligently with the work to eject the contractor and complete the work himself, paying to the contractor any balance remaining after deducting the cost of doing the work. It is generally provided that such action on the part of the owner can only be taken after the architect or engineer in charge of the work has certified that the contractor has been unnecessarily delayed in proceeding.

It has already been noticed that where the contract provides that the work must be completed by a specified date or where no time is fixed and the contract is to be performed within a reasonable time that the owner can put an end to it after notifying the contractor that he must complete his work within a reasonable time. So that where a contract provides both that the work must be completed within a specified time and also that upon failure to perform diligently the owner may eject the contractor and complete the work on his account, the owner has the option either to act under the clause in the contract or to cancel it and put an end to it if the contractor has not completed by the date specified.

The owner in serving the notice upon the contractor ejecting him must make clear whether or not he is acting under the provisions in the contract or whether he is rescinding the contract because of the contractor's failure to perform it. In the one case the owner is responsible to the contractor for the difference between the contract price and the cost of completing the work. In the other there is no such liability.

Accounting Department

Conducted by Harry M. Smith*
Certified Public Accountant.

THE following extract from the writings of A. Lowes Dickinson, C. P. A., while referring particularly to manufacturing accounting, contains many points that apply in principle with equal force to other business such as contracting. All concerns are vitally interested in ascertaining as accurately as possible the points considered hereinafter and necessarily suggestions from such an authority as that quoted are certain to be of value.

Essentials for Ascertaining Correct Profits.

The essentials for ascertaining correct profits so far as stocks on hand are concerned are:

(a) An accurate enumeration of the quantities on hand.

(b) An accurate ascertainment of the actual cost of the different manufactured articles, either completed or in progress.

(c) Accurate clerical work in calculating from (a) and (b) the money values.

(d) A specific reduction in the prices of raw materials and manufactured products of the amount by which the market valuations at the close of the fiscal period fell short of the cost.

(e) A proper provision for all stock which is old or depreciated or for any reason likely to be unsaleable.

The more exactly these different elements are ascertained, the more accurate will be the resulting statements of profits, and if the special reserves under (d) and (e) be made separately, it will be an easy matter usefully to compare one period with another.

Taking the Inventory.

An accurate enumeration of quantities on hand is the most important of these

*Associate Member of the Society.

elements, and is frequently a matter of much difficulty by reason of the necessity of making it as of a fixed common date for the whole stock. Where a plant can be closed down for such period as is necessary to take the inventory, this difficulty is largely eliminated; and it is entirely eliminated where running book inventories are maintained, which can be checked up with and adjusted to the actual quantity on hand at any time, within say twelve months, that the stock of each class if lowest.

In taking an actual count as of a particular date it is as a rule impossible to make the count on that day, and the work must extend over a longer period For this purpose it is necessary to keep careful record of everything coming in or going out from each class of commodity from the time it is counted until the final inventory date inclusive. It is also necessary to note on the original sheets any old, obsolete or damaged stock upon which reduced values should be placed. The ease and accuracy with which such a count can be made, will depend greatly upon the laying out of a systematic plan beforehand by which duplication can be prevented; incoming stock segregated until the count is completed; and outgoing stock selected as far as possible from that which has not yet been enumerated. Furthermore, the enumeration will be much easier in well-ordered stockrooms than in those in which no method prevails; and much time at stocktaking periods can be saved by arranging the storerooms with this among other objects in view.

When all possible counting and weighing has been done there will frequently remain certain important classes which can only be ascertained on an estimated basis, and for which, therefore, it is desirable that book inventories be kept even if these are not a part of the regular system of accounting. The quantities of bulk material such as ore, coal, coke, pig iron, logs and similar articles are always difficult of ascertainment as they are usually from their nature stored in irregular piles, the apparent contents of which will be affected by moisture or by irregularities in or sinking of the ground surface upon which they are stored. Measurements made under such conditions can hardly be more than an approximation to the true figure; although a sufficient degree of accuracy may be generally obtained if the estimates are made by two qualified persons independently of each other. It is important too that a limit should be placed upon the size or extent of the piles in which bulk materials are stored, so that by keeping even a rough account of the quantities put in and taken out from the time the pile is started until it is completely used up, a check can be had upon the accuracy of the quantities at comparatively short intervals; and the piles should not be too large, so that each may be worked out within some reasonable period.

Work in progress is another class involving special difficulties which can often only be satisfactorily overcome by keeping approximate accounts of the labor and material put in, and the finished products taken out, taking care at the same time that a proper allowance is made for wasted material, of which there must necessarily be some percentage.

Scrap material in theory can be weighed, but its quantity, weight and shape frequently preclude any such course and no really satisfactory method has yet been devised for arriving at the quantity on hand with any close degree of accuracy. The best method is to keep a book inventory of the scrap weighed out from the shop into the yard; to store the same in separate piles or in separate locations, and weigh out deliveries; so, by keeping a separate book account of each pile, to prove the quantities up as they are exhausted. A liberal deduction is required in any estimate of scrap stock to provide against possible overvaluation.

Cost Accounting.

The importance of a valuation at cost emphasizes the necessity of such a system of accounting as will enable cost to be accurately ascertained and makes desirable at this point an outline of the principal points involved. The theory of cost accounting, is merely an elaboration of ordinary bookkeeping, and its difficulty lies almost entirely in a correct ascertainment of the elements that enter into it. There is no theoretical difficulty in keeping a record of the number of hours, human and machine, and the quantity of material that enter into any process of manufacture; but practical difficulties arise from the large number of items involved, the chances of error in the tabulation of hours worked and quantities consumed, loss of weight in process and many other minor points, coupled with the necessity of an economical operation of the cost accounting system.

Even when the actual quantities of material and number of hours worked in the direct processes of manufacture are known, there are many other expenses which cannot be allocated to any particular operation and yet are essential to all operations, such as power, light, heat, taxes, insurance, clerical and general supervision; and the determination of the proportion in which these expenses should be distributed to the different processes is a problem which is incapable of an absolutely accurate solution. Almost every business differs in this respect, and various methods are adopted for arriving at an approximation to the result. The essentials are that the total amount absorbed in the cost over any period should not materially exceed, nor fall short of, the total of all such expenses incurred during that period; and that the method of distribution, once settled, should be consistently maintained regardless of the effect on the operations, unless and until a more accurate method can be substituted therefor.

Distribution of Expense Burden.

The following are some of the methods most often used for apportioning these charges, which are generally described as "overhead expense," "burden" or "dead expense."

(a) They are apportioned each month in total over all the direct cost accounts, either in proportion to labor, or to labor and material, or to material only, or partly on one of those bases and partly on another, according to the nature of the expense.

One objection to this method is that deparments that are more fully occupied are made to bear the expense of those not fully occupied or even not occupied at all, thus producing considerable inequalities between the results of any one department in different periods; and perhaps even showing losses on some on department which are usually attributable not to that department at all, but to the partial or total closing down of some other one.

(b) They are carefully allocated in the first instance between separate departments on the basis of one or more of the factors of space occupied, normal possible output, or normal quantity of power required, and then in each department prorated in proportion to labor and material costs as in (a).

This is a more accurate method in theory, and eliminates the error of charging one department with the results of slackness of work in others. It is more difficult to carry out in practice, and involves a good many assumptions in obtaining the division between departments. It is also still open to the objection that there is considerable fluctuation in the incidence of overhead expenses between busy and slack periods, and costs are shown as higher in the latter than in the former.

(c) In machine shops the overhead expense is frequently apportioned over machine hours worked, each machine having a rating ascertained by experiment.

(d) As a result of careful estimates, certain fixed percentage rates on labor, or material, or both, based on a normal average output, are adopted.

In both of the last two methods the rates are at first independent of the actual expenses. The amounts added to costs are credited to certain accounts to which all expenses covered by that rate are charged, and the two should on an average approximately agree. If the difference accumulates, it is due either to errors in the rates which would have to be adjusted, or to an extra busy or extra slack period of operations. Such contingencies should be provided for by including in the burden a reserve based on experience, which, with the addition of the excess provision accumulating in the busy periods, would suffice to meet the deficits due to slack periods. These methods would appear to be better in every way than the first two, as discrepancies in costs due to circumstances not in fact pertinent to the output are avoided and periods varying from the normal are regularly provided for.

All the methods here outlined require much thought and skill in determining the proper classification of expense accounts and their effect on various parts of the operations.

Profits on Work in Progress.

The extent to which it is permissible to anticipate profits on work in progress forms another consideration in the valuation of inventories. When work is being carried out under definite contracts extending over long periods of time, and when it may perhaps be reasonably contended that at any rate some portion of the profit is earned at the time when the work is performed, it is quite a frequent practice to estimate and bring into account some portion of the profit proportionate to the cost for any period, and there does not appear to be any objection in principle to the adoption of this practice. On the other hand, it is undoubtedly more conservative not to take credit for any such profit until the whole contract is completed. Any added reason for the latter course is that unforeseen contingencies are continually arising during the progress of the work with the result that what was originally expected to realize a profit may in the end result in a loss. It is true that the more conservative course may cause large inequalities in the amount of profit shown for successive periods; but if the accounts are stated on a basis of total work completed less cost thereof, the reasons for the fluctuations, as well as the advantage of more rapid completion, are apparent.

Conditions may exist that would render such conservative treatment inequitable to certain classes of stockholders, as for instance when part of the capital stock is of the non-cumulative preferred class, the dividends upon which are dependent entirely upon the profits of each year. In determining profits due regard must be had to such interests so that no substantial injustice may be done them.

If, however, estimates of profits on pending contracts are to be taken into account, it is of the utmost importance that such should be made on an ultra-conservative basis, and further that estimated losses should also be fully provided for. Even where it is not the practice to take up any part of the profits on contracts not completed it may be necessary to provide for losses of an exceptional character likely to arise on similar contracts; neglect to take this precaution may easily result in subsequent disaster by the distribution over a series of years of dividends in excess of profits.

While, therefore, under certain conditions no objection can be taken to the inclusion in a profit and loss account of profits on work in progress a sound conservative policy would be against such a practice unless in very exceptional cases on the ground.

(1) That the best estimates are misleading.
(2) That such profits are not in most cases yet realized and cannot therefore be employed in payment of dividends, except by a corresponding increase in working capital.
(3) That the asset of work in progress is unduly swelled by an addition that may perhaps never be realized.

Reserves for Contingencies.

Of somewhat more importance than the question of profits and losses on contracts, is that of reserves for future expenses on contracts that are apparently completed. These expenses may represent general supervision during a certain period after installation; claims for non-fulfillment of stipulated provisions, either under guarantees of satisfactory performance extending over a definite period or otherwise; or other small adjustments; and on the other side there may be bonuses due after a certain period of satisfactory working. The only really safe way to provide for such contingency reserve, either by charging to each contract a certain percentage, or by setting up specific reserves based on an examination of the results of similar contracts. Reserves so made should be carried as a current liability of the business, and not as a free reserve. Bonuses should not be taken credit for until actually earned by the completion of the specified conditions.

Book Inventories.

The accuracy of the periodical statements of earnings of manufacturing concerns depends to a large extent upon that of the inventory, both as to quantity and value. Without correct information as to the value of the stocks, it is impossible to ascertain the earnings; and yet the delay and expense involved prohibit the frequent taking of physical inventories, which in most cases would necessitate the closing of the works for a period of some weeks, and consequent loss of business. Up to comparatively recent times, it was the practice to take such inventories once a year, closing the works at a suitable date for that purpose; but the demand for more frequent statements of earnings has necessitated some method of arriving at the approximate value of stocks on hand without the expense and delay involved in a physical enumeration thereof. There has by degrees been evolved a system of book records, continuous throughout the year, of materials, work in process, and manufactured products, which enables a book inventory to be obtained each month so accurately that the closing down of large works for this purpose is now very unusual.

These book records consist of accounts, both of quantity and value, kept for each class of material and manufactured product, based on accurate returns of the quantities received and consumed and of the labor expended, and balancing with the principal books so far as money values are concerned. The money value of labor worked is obtained from the analyzed pay-rolls, frequently based on a large number of slips made up either by the individual workmen or by the foremen. These slips form the basis of the entries to the debit of different order numbers in the cost records, and the total of all such debits is balanced with the factory pay-roll. The quantity and values of materials received are obtained from the original bills, analyzed, and charged to the respective stores accounts. The production records are thus obtained from a very large number of small individual records of time and material expended in the various productive operations, which are collected, classified and summarized, and charged and credited to the Production, and Material, and Labor accounts respectively on ordinary bookkeeping principles, with the result that the balance left on any material account should represent the stock on hand, and the balance on any production account, after crediting the finished product, should represent the cost of the completed or partially completed work.

It might be supposed that reports made up by working men, often illiterate, and with no idea of the purpose for which the records are required, would be so inaccurate as to be useless for practical purposes, but a little consideration will show that, apart from any deliberate attempt at falsification, errors would tend to offset each other, and the resulting difference should be comparatively small in proportion to the totals involved. In fact, as in so many other problems of everyday life, the principle of averages obtains, and if ordinary precautions are adopted, the final results are as a rule found to be surprisingly accurate.

Physical Verification of Book Inventories.

As any particular material in stock is reduced to a low point, a physical inventory thereof is easily taken, and any discrepancies found on a comparison with the book records are adjusted. In this way the whole of the material accounts are verified physically at least once in the course of each year without an interruption to the ordinary business. In the case of large bulk stocks, such as ore, pig iron, etc., already referred to, the problem is a more difficult one, because it may be, and frequently is, a period of some years before the piles in which these articles are kept are reduced to a sufficiently small quantity to enable any accurate inventory to be taken. In these cases, however, it is usual to allow a small extra percentage on the consumption to cover waste or loss, with the result that in practice the physical test more often shows an excess over the book record than otherwise.

Material in process of manufacture can often be physically verified when the process is entirely completed, which may be after weeks, months, or, in large contracts, even years. But by a subdivision of accounts into different processes and small units, the book records are being continually verified at each end; that is, by the labor and material which is known to have gone in, and by the processed or finished product which is known to have come out, and provided that the values at which the material is charged in, and the product credited out, are approximately in accordance with the facts, the resulting balance of work still in progress must be substantially correct also.

Accuracy of Inventory Valuations.

Enough has been said to show the vital importance to a correct balance sheet of accurate inventory valuations. Practical experience has reduced to a comparatively simple routine the methods for guarding against possibilities of error, and the serious ones that occur are generally due either to ignorance of both principles and routine on the part of those concerned, or to deliberate fraud in the certification of quantites or values.

There are, however, other causes of shrinkage in value which it is more difficult to provide for. A fall in market prices, a sudden cessation in the demand owing to panic, war, or other disturbing causes may at any time quite unexpectedly either entirely prevent the realization of stocks on hand, or so depress prices as to render such realization only possible at a sacrifice. For such reasons as these it is prudent to build up a reasonable reserve in good times to provide for contingencies that may arise in less prosperous ones. Such reserves, while deductible from the inventory in the balance sheet, should be quite separate from and independent of the inventory itself, and should not be made up by reducing the valuation or prices of specific parts of the stocks on hand.

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The Engineering Contractor

JOURNAL OF THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS, Inc.

Volume II NEW YORK, DECEMBER, 1914 Number 12

ANNOUNCEMENT OF THE ANNUAL MEETING

THE Annual Meeting of the Society will be held in New York, on January 15th, 1915, as provided for in the Constitution of the Society. The Afternoon Session, which opens at 2:00 p. m., will be held in the United Engineering Societies Building, at 25 West 39th Street. The Program for the Afternoon Session will be as follows:

BUSINESS SESSION

2:00 p. m.

Meeting Called to Order,
Address by the President,
Report of the Secretary for the year 1914,
Report of the Treasurer for the year 1914,
Reports of the Various Committees,
Report of the Special Committee appointed to revise Committee Work,
General Discussion,
Report of the Tellers,
Address by newly elected President,
Adjournment.

EVENING SESSION

7:00 p. m.

BANQUET

In the evening, at seven o'clock, the Society's banquet will be given at "Bustanoby's" at Broadway and 60th Street, New York. By special arrangement the Society has been able to obtain an unusually fine menu at only $1.00 per cover.

CABARET, MUSIC

While the Banquet is in progress, entertainment will be furnished by a corps of professional entertainers. Speechmaking will not be permitted.

MOTION PICTURES

COMMERCIAL

Motion pictures will be shown illustrating the manufacture of National Pipe, the product of the National Tube Company of Pittsburg, Pa. These pictures are exceptionally interesting and show the various processes in the manufacture of the product from the extracting of the ore from "Mother Earth" to the finishing of the pipe. Mr. C. F. Roland, representing the Company will be present to explain things as the pictures are thrown on the screen.

COMEDY

Then will come a few reels of the famous Comedy Pictures right from the laboratory of the Keystone Company.

Hints to Contractors on Hiring and Keeping Good Men

IT is always a comparatively easy matter to criticize and find fault with people, conditions, and methods, and quite difficult to do better or advise how improvements can be made. This is very true of handling men on construction work. It is not possible to give exact rules and regulations that can be followed in every case, for men themselves, both those to be managed and those doing the managing, are strikingly different, and the conditions under which men must be worked vary greatly; but some general principles can be laid down and advice given that can be applied by discerning contractors and managers.

First, is the employment of men. Laborers cannot be employed with the same care and scrutiny that should be used with foremen, clerks, bookkeepers and mechanics, but some discretion should be exercised. It is a poor way, generally bringing bad results, to allow foremen to hire the men. Few foremen seem to have much judgment in selecting men, and it is not within the province of foremen who have to work the men to hire them. This sometimes leads to serious abuses. The writer knows of one contractor who allows a stable foreman to hire all of his teamsters. This boss soon found that he could make money by charging the men a fee for giving them a job. Thus the engaging of men became so profitable that many of them were discharged so that the foreman could hire new ones, making more money. Then men began to pay him to hold their jobs until the system of monthly payments was developed. It is evident that this contractor does not really control his work, although he may think he does. This teaming is controlled by his foreman, who is grafting on his men, but the cost of all this is coming from the contractor. Many similar cases could be mentioned from the writer's own knowledge. The easiest way to prevent such grafting is to cut off such power from foremen.

If the contractor is carrying on small operations, he should employ his own men; but few contractors can do this, so it is well to have one man on each job to do the hiring of men for the construction work. In most cases this man will be the general manager or superintendent, but on some large jobs he, too, may be too busy to give time to this important detail. Then another man must be selected. The man who is allowed to do it must not be taken up with his own importance, which is a common failing of too many men who are given some authority that can be exercised before the public. This kind of man is as apt to employ the worst men applying, as he is the best, for he will be attempting to impress the men, instead of forming a fair estimate of their ability.

It is a difficult matter to judge a man for both physical and mental work. For a common laborer at the usual wages paid it is not expected to obtain a man of great mental ability, nor is it always a requisite; yet the greater the intelligence up to a certain point, the quicker the man is likely to learn and the better his work will be. However, a man of great mental ability, even if he has the necessary physical strength, is not as likely to do monotonous physical work as well as a man of less intelligence. The thinking man will soon become dissatisfied, for instead of having his mind on his work, he is apt to be thinking of other things and planning for himself. A strong man of fair intelligence makes the best manual worker. These remarks do not apply to mechanics.

To get physical endurance does not mean to select large men. They are frequently strong and able to put forth great exertion for a short time, but the man for endurance is the average sized man of stocky build. He is apt to be quicker in his movements than the large, heavy man, will size up easier with other workmen and can keep up a regular pace much longer. The stout man is often very strong and answers for many different kinds of work, but he is not suited for all kinds of laboring. The undersized man is to be preferred to the large man as a general thing.

The short man has many advantages in stooping over and working close to the ground over the large man. The man with broad shoulders and well developed arms and with a tapering body is well suited for such work as picking, using an ax, or striking hammer or maul. The stout heavy man is suited for work with a bar, dumping carts and scrapers, tilting mixers and other work where weight and great strength are needed for a short time. The man with a muscular back, broad hips and stout legs is suited for heavy work that needs endurance. These and other physical characteristics should be studied in selecting and hiring men.

Under many circumstances nearly all men applying for work will be hired; then the selecting of men for different kinds of work will depend upon their physical appearance, and this should be a guide even after the men become known from weeks and months of work. It is only too common to see men placed at work for which they are not suited physically.

It is not as easy to select men for intelligence as it is for physical ability, yet every employer should attempt to get laborers of fair mental ability, although the man of low intelligence can also be made to do efficient work if intelligently handled and guided.

The man with eyes set far apart, with heavy jaws and a stout short neck, inclined to give his head a drooped appearance, is generally of low mental calibre. The man with eyes far apart, long thin neck and short pointed features possesses more intelligence than the other and is generally easily led and managed. He is seldom sure of himself but can be encouraged to do any physical work under a competent foreman. The man with deep set eyes, with angular features, is one that is sure of himself and his ability. He takes himself and his work seriously, is difficult to manage for he feels he does not need a boss, but if handled right can be worked as desired and led to improve on his fellow women's methods.

The man with the close set piercing eyes and strong facial features possesses more than the average intelligence. He should make the best and most intelligent workman, but his mental ability often makes him the shirker, the "slick" one, who gains the good will of his incompetent fellow workmen by helping them to beat the boss. He is the man who, in spite of his intelligence, must be driven and kept so busy that he cannot get himself into mischief.

The great mass of the common laborers possess little in their faces to show their mental ability, so that such men can only be known by working them.

All these and many other things are considerations in hiring men, especially when selections can be made from a number of applicants.

When men apply for work there are a number of things they should be told promptly. First, the wages paid and the hours of work. Also when pay days occur, and for what period of time they receive their money on each pay day. For city work this about covers the conditions; but for work on jobs in the country, where men must board or live in camps, then more should be told them, such as the price of board, or how they can get their supplies, the charge for bedding and for fuel, if one is made. The cost for doctor's attendance and hospital service should all be explained. Machine runners and mechanics should be told the rules and regulations governing their work, the care that is to be taken of the machines, and the periods of cleaning and overhauling them.

The easiest method of doing this is to have these various regulations printed in a small pamphlet and, when employing men, to allow them to read it. Men who cannot read will find some one who will read to them. The applicant, if he is not satisfied, can refuse employment, but if he accepts a job, he agrees to abide by the regulations. This prevents a lot of trouble and to some extent makes a contract between the employer and his employees. If a man's work is limited, the regulations can be written on a typewriter and a number of carbon copies made. A half dozen copies will last a long time, as they are kept in the office, the men returning them after reading.

In employing others than common laborers, as foremen, mechanics, machine runners and clerks, it is necessary to ask questions in order to learn what experience these men have had in the different lines of work. This only serves as a part guide, for many of these men become very expert in telling of what they can do and have done, appropriating to themselves the experience of others upon the jobs on which they may have been employed. Many of them show letters of reference, stating they were employed by different contractors. These letters are of little value. Naturally letters of reference are not given to men who have been discharged in a fit of anger by their employers, or for breaking up machinery by ignorance and carelessness. Neverthless many men are put off because of poor ability or are gladly let out at the end of a job, who could not find employment again from the same contractor except in a pinch, yet letters are given them stating that they were employed and possibly recommending them to others. This is done to get rid of the men without offending them. This fact makes the value of all letters of reference or recommendation held by such men questionable.

A contractor carrying on small operations cannot afford to hold men even on half pay from one job to another, or from season to season, but a contractor running a large number of jobs and amounting to a large sum in the aggregate will find temporary employment for his best men during the off seasons or between jobs, or will carry his men on full or half

pay. To others, whom he cannot afford to take care of in this manner, he will promise re-employment as soon as he can use them. Thus his good men are cared for during slack periods and few of them are looking for jobs. Even if he lets them go without promises, he is glad to hire the capable men again as soon as he can use them. Indeed, a contractor carrying on large operations considers the men of ability in his organization or those formerly in his employ, whose addresses he endeavors to keep, as one of his assets. One trouble a man starting into contracting has is to obtain and hold competent men. He is not able to pay large salaries and the best men in the business have jobs and can only be induced to leave their present employers by offers of larger salaries and regular work.

Thus the contractor looking for such men, can question applicants and pick out those he thinks may be competent, but the only way to be certain of their ability is to try them. A discharged man may have learned a lesson from his discharge and thus become a valuable employee.

The foregoing remarks have been based upon the assumption that men are plentiful and a contractor is receiving many applicants from men, so that he can exercise some choice: but at times workmen of all classes are scarce and the contractor is compelled to employ anyone that he can get. Then he must work them, good or indifferent, until he can obtain a better class of help.

In many cases men are so scarce that the contractor must rely almost entirely upon labor agents to obtain most of his help. The machanic and various kinds of union men can sometimes be obtained through the labor unions, but even these in some places may have to be obtained through labor agents. It must be remembered that labor agents pay a license to do their business and sometimes, where they send men from one state to another, they must pay a large fee as an immigrant agent, so that these agents must make money through supplying men. They have office rent to pay, and must hire subagents to furnish men from congested labor markets of centers, likewise runners to collect men and deliver them on jobs. They must sometimes furnish men with lodging and food. They also have to advertise to obtain men, and likewise to place men with employers. Thus labor agents are under heavy expenses, and they must do a large business to make a living. Like the dealers in horses they must place the poor ones as well as the good ones, for all is grist that comes to their mill.

A contractor makes a mistake in simply ordering a lot of men from a labor agent. He will obtain in this way an indifferent lot, many of whom will be worthless from the start. Others, who may be competent, we feel disappointed in the conditions surrounding the work, or feel that they have been deceived by the agent. They accordingly leave the work and carry many others with them. No matter what results the contractor obtains from the new workmen, the labor agent has done his part and earned his fee.

With a padrone furnishing men, conditions are slightly different. The padrone has to look after the housing of the men, their board and supplies. He, too, must suffer if the men are dissatisfied, but even with the padrone worthless men may be procured. The padrone system has been discussed in these columns before.

No matter how the men are obtained, either direct from a labor agent or through a padrone, it is well, if any number of men are to be hired, to send a responsible man to see the new men before they start for the work, unless the job is in the same city as the labor agent's office. The rules and regulations as to pay, hours of work, boarding and many other matters of vital interest to the men, previously mentioned, can be told to the laborers before they leave the charge of the labor agent. Photographs of the camp and work can be shown and many other things done to win the confidence of the applicants. Then the men can hardly be deceived and the party of men after reaching the work are likely to stick, with the possible exception of one or two. A shrewd man in looking over those applying for work will exclude some that are likely to prove worthless and will likewise reject any "sea lawyers," who are more than apt to make trouble.

The labor agent may object to some of these things being done, but if he is handled in a courteous manner, and given to understand that the contractor will give him more business if he can obtain satisfactory men, his objections will be withdrawn. The chance of the contractor's own agent grafting on the men with some labor agents, who care little for their own reputation, is considerable. For this and other reasons already mentioned the contractor should only send a responsible man on such a journey, one whom he can trust.

These things show the necessity of having at least one man, and sometimes more, on the job, who can do the hiring of the men, laborers especially. So vital is this matter to the contractor that he should do his part of his work himself; but if this is not possible, and he must rely on others, then he should keep in touch with the men who do his hiring and give the matter as close supervision as possible. Such men should not be drinkers, for they are likely to bring more injury onto the contractor than would the labor agents. The contractor should make it convenient to be present from time to time with his hiring agents and also go on trips with them to engage men. In all these matters it is the contractor's money which is at stake.

—*The Contractor*

Estimates of Cost and Bills of Quantities.

Many contractors would like to obtain the engineer's or architect's estimate of cost of proposed work when preparing their bids and frequently we hear of a movement started to try and induce engineers on private work and engineering departments in public work, to furnish their estimates.

Careful contractors, however, do not want to know what the estimate of cost is before they bid—and while eager to know it after they have put in their bid, are simply curious to compare their estimate with what the engineer thinks the work should be done for. **A contractor who has experience and right training behind him is the best judge as to what the work ought to cost and he will never be misled in making out his figures, by the more or less theoretical estimate of the engineer.** As work is going, especially on state highway work, it is far better that the contractor should remain in ignorance regarding the engineer's estimate of cost, for should he put in a bid on some of the contracts based on the engineer's figures, he would go pretty wide of the mark even as to actual costs, to say nothing of a reasonable profit. This fact is proved by the raising of the engineer's estimate on re-advertisements in several instances—one may be cited where the estimate was raised from $132,000 to $178,000 on the second call for figures.

It is however essential to right bidding that the engineer prepare a careful and accurate bill of quantities of the work to be done, this is to be made a basis for comparing the bids submitted for the work. We have observed that where engineers are accustomed to furnish an accurate list of quantities that the proposed work attracts the widest attention among the contractors, especially where the approximate quantities are published beforehand so that the contractors may know without further investigation whether they want to figure the work or not. Frequently work about whose magnitude or exact nature nothing can be told from the advertisement inviting bids, is passed up by a busy contractor for that very reason—he cannot tell without spending considerable time in going over the job whether he would care to bid or not and hence passes it by where he might make a special effort to figure it if he had before him the published quantities of the various classes of work.

Building Quantities Needed Too.

The same applies to building construction where the quantities of material are never known and each contractor has to figure them out for himself. It has come to be universally recognized that the main cause of the wide variance in bids for buildings is to be found in the fact that some important feature of the work is forgotten in preparing the estimate—the sash and doors are left out, or the glass, one story, etc.—whence arises the old story of the successful bidder, when told he is the "fortunate one," sitting tearing his hair and trying to determine just what it was he forgot.

If architects began to figure out definite bills of quantities, as engineers are more universally making it the custom to do, they would find that they would get a much better class of bids and be assured that the contract would be carried forward safely—thus increasing their own reputation as successful architects as well as more fully protecting the interests of the owner. No architect and no owner ought to stultify himself by letting a contract when he knows the contractor has forgotten something or has submitted a bid which on the face of it shows it is far below what the work ought to cost. This, however, has been done, and we remember one instance where on a large building the low bidder was called in an hour after the bids were opened and urged to sign the contract. He however was not new at the "game" and instantly thought the anxiety to get him to sign up was an effort to take advantage of a too low bid. His caution told him to refuse the contract, which he did, afterwards to find out that his figures were so far below any others that the architect and owner knew he had forgotten something. In going over his figures he found he had forgotten one important item whose cost represented much more than the best profit he could expect to make on a job of that size.

Which brings us to the question of "quantity surveying," a practice which where established has been found to work to the advantage of all concerned—to the owner, the architect, the contractor and the material man. It is a practice which ultimately, we believe, will be universally adopted. Do not let its discussion cease.

—*Southwest Contractor.*

Efficiency Engineering Applied to Highway Engineering

By Frank B. Gilbreth,* Consulting Engineer, New York City

IT is a fortunate thing for engineers that from its very start Scientific Management was understood to apply to the work of the engineer. It has been the custom for some years to ascertain the science of management especially with shop work and to believe that its principles are most successfully applied in manufacturing, but, as the breadth of the field of application of the principles of Scientific Management has become better understood, it has been realized that there is no field of activity to which the principles do not apply and that there is no type of work, office work, shop work, field work, manufacturing, constructing, selling, advertising, etc., which cannot be done better, if the theory of Scientific Management be understood and the practice of Scientific Management be applied.

Principles Defined.

The principles of Scientific Management have been defined by Mr. Taylor as four:

1. A development of a science for each element of a man's work, which replaces the old rule of thumb method.
2. Scientific selection and training of the workmen.
3. Hearty co-operation between management and men.
4. An almost equal division of the work and the responsibility between the management and the workmen.

This order is that of the development of the science of management. For purposes of installation we might change the order a little, and say that we are to do four things:

1. To functionalize the work so that each member of the organization does that part of the work that he is best fitted to do.
2. To inculcate that spirit of co-operation that will make each member willing to do the work that is assigned to him.
3. To standardize.
4. To teach each member of the organization so that he can best perform his part of the work.

Having thoroughly laid out the problem on the human side and on the material side, and laid out a method of attack to the desired result, it is necessary, before actually making any changes, to insure the hearty co-operation of every member of the organization. This is done by various methods.

1. By an educational campaign, by explaining so far as is desirable and desired the entire plan of Scientific Management and the plan of application to the line of work attempted.
2. By beginning the actual work so far as is possible on the management side. This for two reasons.
   (1) The management side in the majority of cases needs the work most.
   (2) The men will be much more willing to have the system applied to them, if they see it being applied to the management.

Co-operation, once secured, can be held by seeing that every step is made in the open and by seeing that every man receives a suitable, prompt, assured reward for everything that he does.

* Member of the Society

Concerning Standardization.

Having laid out your plant and secured the co-operation of your men, it is necessary to standardize. Standardization consists of two parts:

1. Securing a standard.
2. Applying the standard.

I will consider the application of the standards first as the subject is less technical, and as so many standards have been already established that you will be able to apply the result of the work of others in many cases before finding it necessary to take the actual measurements and find the actual standards for yourself. Devices, while they must in no way be confounded with the science of management, are excellent in applying the principles of standardization. According to the rule just given—that work should be done on the management side first—I will show you a few office standards which may be easily established and which will help the management and office force to visualize the problem of standardization. In themselves these devices are nothing; as showing the importance of the principle of standardization they mean a great deal. The cross-sectioned desk with its standardized equipment, and the arrangement of the various drawers for the various types of work will not only interest everyone about the plant, but will so substantially cut down the work of all using them as to insure sympathy with as well as interest in the work. More than this, in our personal experience they have inculcated a spirit of "thinking in least motions," a better method of attack, which has proved a most valuable asset. This same spirit has been the result of the installation of standard devices in the shop. I will show you the bulletin board, which applies both to the planning and the performing department, the tool room, the tool stand and the assembling packet. The bulletin board is universal in its field of application. There is no one in the organization whose work may not be handled on the bulletin board. It thus serves as a unifying point as well as a standard method of handling work. The tool room, while actually operated by but a few men, affects the work of the entire performing department and is an admirable object lesson as to the benefits of standardization. The assembly packet, while invented to cut down the motions of the assembler of a braider, illustrates a principle of so placing material that it can be handled with the greatest care that is, as you can readily see, applicable to every type of work.

We will turn next to the derivation of these standards. They are the result of that accurate measurement that gives management its claim to be a true science. The methods of measurement, as you know, are time study and motion study. Time study, upon which the science of measurement hangs, is a determination of the elementary unit times necessary to perform an operation. Motion study is the determination of the paper elements to be timed. The two are parts of one whole, i. e., accurate measurement.

Last, but not least in importance, we come to the training or teaching of the men. This is done, directly, through instruction cards and through the functional foremen, who are all specialist teachers; and, indirectly, through the installation of Scientific Management itself. Everyone in the entire organization, management and men alike, if the installation have been properly done, becomes interested in the science of management and in the method of attack which it employs. This interest is the greatest educative force in Scientific Management. If you develop this interest in the subject, the application of the principles of the science of management to your specialty is bound to result not only in success to you individually but to the profession to which you devote your lives.

Arbitration Clause in Specifications

A somewhat unusual provision is contained in the general specifications for a good-sized drainage undertaking that is now being advertised for bids. After the customary statement regarding the powers of the engineer to determine all questions respecting the true construction or meaning of the plans and specifications, there is a clause which states that:

"However, should either party consider itself aggrieved by any decision, it may require the dispute to be finally and conclusively settled by the decision of Arbitrators; the first to be appointed by the Commissioners, the second by the contractor and the third by the arbitrators thus chosen, or by a majority of them, both parties to this contract shall be finally bound."

There has been in the last few years a great deal of agitation for the insertion of an arbitration clause similar to the above in building specifications, and in a number of contracts for work of this kind placed recently such a provision has been made. It is probable also that many general construction specifications in the near future will contain provisions for the submission of disputes to arbitractors. — *Engineering and Contracting.*

New York Labor Law and Contracts

The Public Service Commission of the First District, New York City, at a meeting last week refused, by a vote of four to one, to adopt a resolution, declaring forfeited a contract between the city and the Dock Contractor Co. for the construction of that section of the Broadway subway, Manhattan, lying between Bleecker St. and Union Sq. Representatives of organized labor had previously complained to the Commission that the company had been violating the labor law, in failing to pay the prevailing rate of wages for stone masons. Hearings showed that the violation had been committed by a sub-contractor, but that the contractor had put a stop to it as soon as the complaint was made. The labor law provides that violation shall work a forfeiture of the contract, but counsel to the Commission held that such a forfeiture could not be declared unless it were shown that the contractor had actual or constructive notice of the violation, which was not the case in this proceeding.—*Engineering and Contracting.*

Board of Public Works Defends Contract Plan

THE Los Angeles Board of Public Works has replied to Efficiency Director Burks' proposal that the city undertake its own street improvement work, in a strong defense of the contract plan and the economic advantages of the general principles upon which the present methods of accomplishing public improvements is based. While we believe that Mr. Burks' proposal is based upon fallacy and the contract plan is the only feasible way of handling public work, there are, on the other hand, several features in the present manner of handling public contracts which should be remedied for the benefit of both the public and the contractors—features which we will take up for discussion later. The Board of Public Works' report in full follows:

"As the executive and legislative officers of the city, largely responsible for the conduct of all its official affairs, the Board of Public Works deems it proper to report to you the results of its efforts to ascertain the methods by which $1,000,000 per year might be saved in constructing the street improvements of the city, as set forth by the director of efficiency of the city. We had sincerely hoped that a practical and lawful plan might be suggested by the efficiency expert which would result in a municipal saving, if not in the particularly large and pleasing amount of $1,000,000, at least of something substantial.

We regret to report, however, that, although given every opportunity, the efficiency director has failed to present any concrete plan. He has, indeed, submitted some extravagant and unfortified estimates of possible economies of the same general nature as the original one of $1,000,000, but which fail to correspond therewith to the extent of $120,000, being an increase of that amount, and raising the sum of imaginary economies to $1,120,000. These estimates are sustained by no evidence of any character, except the positive and unqualified assertions of the efficiency director and the wholesale discrediting of all past or present municipal authority or experience, so far as Los Angeles is concerned.

Our report in detail follows:

The Efficiency Commission recently submitted to the City Council certain proposed amendments to the city charter. In the way of argument in favor of Amendment No. 1, which transfers a large portion of the powers of the city government to a city manager, the director of the Efficiency Commission made sweeping claims that enormous savings would be made by its enactment, ranging from $1,000,000 to $2,000,000 per annum. Specific mention was made of such sums as $50,000 in the city treasurer's department, $60,000 in the water department, and $1,000,000 in the street improvements, which are in charge of the Board of Public Works. The saving of $1,000,000 would be effected by the city doing the work directly instead of giving it out by contract.

The basis of the efficiency director's claims of saving rests upon one radical change—that of the city doing all street improvement work instead of letting it out upon competitive bids as at present is the custom. The cost of such work during the last fiscal year being about $4,000,000, the efficiency director assumes that had the city performed the work itself there would have been decreases in costs amounting to $1,120,000, which he divides into six items. We have made a careful study of these several items, and present herewith the result of our investigation, which is, briefly, that none of them have a sound basis.

Before considering these six items separately, it will be noted that two very important features are assumed that at present do not exist, and these two features are essential to all the others.

First, there must be a municipal plant of vast proportions, sufficiently large to perform all the work that is now turned out by all the concerns that contract for city improvements. This investment, the city engineer estimates, would amount to little less than $2,000,000.

Second—and a more difficult matter than the first—an enormous fund would be necessary to carry on the work, and for a revolving fund with which to "carry" the deferred payments. Most of the street paving and similar work is done under the State law known as the Vrooman Act, which spreads the payments over a period of ten years upon a bond resting upon the particular property improved. This fund could not well be less than $10,000,000, and might easily reach $20,000,000.

To provide these two preliminary essentials to the efficiency director's plan—a municipal plant costing nearly two millions, and a great revolving fund of ten to twenty millions more—bonds would have to be voted. Whether the people of Los Angeles would be willing to add to their present large bonded indebtedness ten, fifteen or twenty million dollars additional to "try out" the efficiency director's proposed experiment, upon the doubtful assurance that it will come out all right in the end, is open to much doubt. In the present state of the public mind, we believe it highly improbable that such bonds would be voted. Upon this contingency, however, rests the possibility of even testing the six suggestions of the efficiency director, which we will now consider in their order:

"(1) Elimination of contractor's profit of 10 per cent, $400,000."

"(2) Increase in efficiency through the application of scientific management; a minimum of 5 per cent, $180,000."

These two items may be considered together. The first assumes that the contractors, as a whole, net 10 per cent., which is doubtful, and that the city, with all the limitations that attach to municipal work, could do it all at less than the cost by contract, which is even more doubtful. The competition for city work is very keen, and the prices received for such work are very low, compared with those of other cities. One of the largest contracting firms in the United States, doing business in nearly all the large cities, East and West, and which has worked in Los Angeles for years, has quit this city because it could make no profit.

The efficiency director says that the city could do this work not only at as low a cost as the contractors, minus whatever profit they make, but $180,000 less than that. This would make an aggregate of $580,000. This statement is a pure assumption. However, an investigation made in seventeen American cities, reported in the Engineering Record shows that the cost of force account work by those cities was about 25 per cent. higher than by private contract.

"(3) Reduction in cost of financing during construction period and cost of collecting assessments (2½ per cent.), $100,000."

If the people are to vote bonds for the proposed revolving fund, there doubtless would be some reduction in this item on the one hand, but against this would be the interest running against the city on the revolving fund bonds. There would also be some cost of collecting assessments. The net saving, if any, would be small.

"(4) Reduction of 2 per cent. in interest charges on $8,000,000 outstanding bonds, by utilizing city's credit, $150,000."

These $8,000,000 bonds are not bonds of the city, but are what are known as "Vrooman Act bonds," running against private property which has been improved in the past and which is receiving the benefit of the improvement. While it would be a much appreciated act of benevolence to refund these bonds at 5 per cent. instead of 7 per cent., it is not clear how this 2 per cent. charge comes to be reckoned into the charges for street work for the current year, excepting as one of the necessities to make up a round million of prospective saving. In any event, the revolving fund bonds must be voted by the people before this item can be made available. Moreover, the city could not secure these bonds without paying the penalties provided in the law, which, together with legal obstacles, make the process out of the question.

"(5) Reduction in cost of 300,000 barrels of cement by operation of Monolith plant: supplying cement at maximum cost of $1.40 as against present cost of $2 per barrel, $180,000."

The efficiency director verbally explained that he estimated the cost of manufacturing cement at the Monolith plant at $1 per barrel, and 40 cents per barrel for freight from the plant to Los Angeles, making the total $1.40 per barrel. From the beginning of operation at the Monolith mill, in March, 1900, to March 31, 1913, there were 891,648 barrels of cement manufactured, at a cost for operating expenses of $1,689,292.24, or an average cost of $1.894 per barrel. This includes periods when the mill was running on part time, and also all repairs and replacements, and 10 cents per barrel for depreciation of plant. It does not include anything on account of the investment in the plant, which was about $850,000. There was said to have been about 150,000 barrels manufactured at a cost not to exceed $1.15 per barrel for operating expenses, and probably a small amount as low as $1 per barrel. The building of the Monolith mill was doubtless justified by keeping down the price of cement; and now, running at its full capacity of 1200 barrels per day, if the city offered a market for that full amount, it could probably be manufactured at some profit. But as to manufacturing cement at $1 per barrel, the efficiency director is entirely wrong, and he will find no one of experience who will agree to undertake the work.

"(6) Elimination of cost due to lack of proper provision in placing the sewers, water and gas pipes and other substructures before paving is completed, $100,000."

That sewers, water and gas pipes and other substructures should, if possible, be put in before paving admits of no argument. Under the laws, this cannot always be controlled, but, so far as possible, the City Council and this board insist upon the various utilities going in in their proper order. That losses on this account amount to $100,000 per year is incorrect, and they were doubtless put at that figure to give full measure, and something over, to the round million of possible savings.

Summing up these six items suggested by the efficiency director as likely to produce a saving of $1,120,000 annually, we are unable to discover that any one of them has the merit claimed. Instead of saving that amount out of the 4,000,000 expended during the last fiscal year, and reducing it to $2,880,000, we are firmly of the belief that, including interest on the proposed "revolving fund" of $10,000,000 or more, the outlay would have been considerably in excess of $4,000,000, and nearer to $5,000,000 than $4,000,000. We wish to avoid the loose and reckless use of figures which characterizes the efficiency director, and make no attempt to name the exact amount of excess.

The efficiency director censures the Board of Public Works for not doing the street improvement work direct by the city, and claims that the present charter provides a way for doing this work, and cites the alleged fact that the city of San Francisco is doing such work direct. The efficiency director seems to think that all public work is subject to the same legal conditions. There are two kinds of public work, between which there is a very broad distinction. One is such work as is done by the city with its own funds, either derived from taxation or from bonds. The other is for local improvements, the funds for which are raised by assessing a limited locality. All street work, sewer work, etc., comes under this heading. The city may, in doing work with its own money, do work direct by force account, and probably by other means. It is in this way that the aqueduct work was done direct by the city. When, however, the work is done for a locality with funds raised by assessments upon that locality, the situation is entirely different. The laws governing such work are precise in all the steps that must be taken to make a valid assessment, and provide that it must be through competitive bids and by contract.

The San Francisco charter, like the Los Angeles charter, originally had no provision for creating assessment districts, and the supreme court of the State, in the case of Gassner versus McCarthy, June 2, 1911, in 160 California Reports, page 82, decided that San Francisco did not have the power of creating an assessment district. The San Francisco charter was thereupon amended so that the city was given power by ordinance to provide for the creating of assessment districts, and an ordinance was passed providing for the formation of assessment districts and setting forth step by step the manner in which public work may be done, including the advertising for competitive bids and awarding same to the lowest responsible bidder. The ordinance closely follows the State laws governing public improvement work. After the adoption of this charter amendment and the ordinance thereunder, the supreme court in a second decision of January 29, 1912, in the case of Mardis versus McCarthy, decided that the latter law, under the amendment to the charter, was good, and that the city could, under the ordinance which it had adopted, create an assessment district.

The Los Angeles charter does not contain any such provision as does the amendment to the San Francisco charter referred to, neither do any of the proposed ten amendments contain any such provision. Therefore, the city does not appear to have any present or prospective legal authority for doing the street improvement work direct where the funds are raised by local assessments and paid in bonds. If the Efficiency Commission had desired the city of Los Angeles to make its own assessments under its own charter provisions and ordinances, it evidently blundered in not bringing in an amendment, with the other ten, making such provision as was made by amendment to the San Francisco charter.

The loose and reckless use of figures by the efficiency director, which if not analyzed would produce a false impression, is illustrated in one of the articles of propaganda written by him and published in a daily newspaper under the captivating caption, "To Save a Million." Describing the manner in which some contractors finance their operations, the efficiency director says:

"The contractor agrees to turn over to the party who advances the money the 'warrant' which authorizes him to collect the assessments on the completion of the work. The usual charge for the advance thus made is 10 per cent. for the period of two or three months before the assessments are due plus 3 per cent. for collection, making 13 per cent. as the cost of financing the operation for this period. This, it will be seen, is at the rate of 52 per cent., assuming the three-months period for construction work."

After describing the "revolving fund" plan for financing public work, the efficiency director adds:

"This method will enable the city to finance public improvements at the rate of 5 per cent. a year instead of 52 per cent. a year."

When asked by the board if he really meant that it was now costing 52 per cent. to finance the public work, the efficiency director disclaimed the intention of creating that impression. What impression he did intend to convey is left to conjecture. When asked if all his estimates of savings were based on as fair statements as this in regard to the 52 per cent. outlay, he replied that they were, absolutely.

The board made inquiry as to the particular case mentioned by the efficiency director, and found that the contractor borrowed about one-half the amount of the contract price and paid 8 per cent. on the entire contract, for interest and collection, which is not quite so spectacular as 52 per cent.

As a matter of fact, a majority of the contractors get their accommodations at the banks at as low a rate of interest as any of their customers—5, 6 or 7 per cent.

Much of the remainder of the communication of the efficiency director, a copy of which is transmitted to you herewith, is devoted to a treatise on the subjects of organization and administration. These elementary subjects are treated with much of the show of wisdom which is displayed in current magazines devoted to business success and by the outgivings of the correspondence schools. The desirability of efficiency in public affairs is recognized and striven for by all well-informed and conscientious public officials, but it seems to be regarded by the efficiency director as a recent discovery which for the first time is being presented to the attention of the city officials of Los Angeles, all of whom are "inefficient," "stupid managers" or "amateurs." Those who have served the city in years gone by, if not worse, are at least no better, in his estimation.

We had supposed that the efficiency director had been employed by the honorable Mayor and City Council to assist the various officers and boards of the city in bringing about greater efficiency in their various departments. Indeed, we find that the duty of the Efficiency Commission is "to recommend to the City Council and to the respective officers, boards and commissions of the city measures for increasing individual, group and departmental efficiency." So far as this department is concerned, however, we have waited in vain during the months of service of the efficiency director, who is paid a generous salary, for the first helpful suggestion as to the manner of conducting the work of this department, one of the largest in the city.

So far as the Board of Public Works is concerned, it has had an honorable record of achievement for ten years. Its membership in the past and at present has not been of "amateurs" in public affairs, as has been stated and repeated by the efficiency director. Under the direction of such men as the late Lieut. Gen. Adna R. Chaffee, A. A. Hubbard, James A. Anderson, D. K. Edwards, Edward Johnson and William M. Humphries, and with a splendid corps of engineers under the leadership of William Mulholland, this Board of Public Works constructed the Los Angeles Aqueduct, one of the really great engineering feats of modern times, as well as the city's portion of the Los Angeles Harbor construction and the Los Angeles Aqueduct power works, in addition to the usual municipal improvement work which during this period was of stupendous proportions. All this was done with such conspicuous honesty, fidelity and ability as to have attracted national attention and commendation. So far as the membership of the present board is concerned, it would be unbecoming for us to speak further than to say that we are sincerely endeavoring to maintain the high standard of official conduct set by our distinguished predecessors, both as to integrity and efficiency.

With this high object in view, we have thought it seemly to report to you, the Mayor and City Council of Los Angeles, the result of our investigation of the statements of the efficiency director.

—*Southwest Contractor.*

Contract Plan vs. Force Account

The great objection to, and the real cause of failure of municipally operated business enterprises, is the seemingly unavoidable and unusually painful apparent lack of efficiency in the organization of public employes. From whatever cause it may arise, men cannot seemingly be induced to work as hard or efficiently when they are paid out of the public treasury as when their wages come from a private purse. This fact is all the more evident the further a construction gang is from headquarters. Either no effort or wasted effort characterize in too great degree the average public work gang. This fact alone would account in large measure for the fact, commonly accepted we believe by engineers who have had experience with force account work, that this method of conducting construction operations is quite as costly, and frequently much more so, than the contract plan.

No one believes that a municipality

could hope to save, by undertaking its own construction work, more than the profit made by the contractor. It could not do more in this day of keen competition between contractor, when the inefficient or poorly trained contractor is by this same competition quickly forced out. And while we are not ready to admit that the city can, except in exceptional cases, save to the property owners even the contractor's profit, what would be the real gain even if it could and did accomplish this? Is it conserving public welfare to save a thousand property owners one or five or fifty dollars apiece if a number of private business organizations are thereby destroyed?

—*Southwest Contractor.*

Errata

On the Ballots and in the November issue of the Journal, Mr. William I. Bishop of Montreal, P. Q., was cited as Chief Engineer of The Quebec Streams Commission. This is an error and should read: Mr. William I. Bishop, Commissioner on The Quebec Streams Commission Board. Mr. O. Lefebvre is the Chief Engineer of The Quebec Streams Commission and also a member of this Society.

That Banquet of Ours

This is simply in the way of a reminder that there is a date in January which should not be overlooked by any member of the Society, and that day is the 15th. Take your blue pencil now, walk over to your wall calendar, and mark a big X where you will see 15. That's all and then be sure to attend.

Make Reservations Now

It will facilitate matters greatly if you let us make reservations now for you and your associates who you desire to invite. The tickets are one dollar per cover and remittances should accompany your request. It is necessary that we ascertain at least a week before the date of the dinner, just how many will be in attendance so that the management of Bustanoby's can make arrangements which will insure the comfort of all.

Engineering Law

By William L. Bowman*
C.E., L.L.B.

Legal Suggestions for Engineers

We are in a day of continuous lawmaking and no saying is more true and serious than the time worn adage "Ignorance of the law is no excuse." The answering of questions where the law is desired depends on the special facts in each particular case; and a decision in engineering matters may be reversed at any time, even though it has been a precedent for many years.

With our present day methods of building construction the burden of all such construction has fallen chiefly upon the engineer and it will continue so to do more and more in the future. The architect still plans and outlines the work but it is the engineer who is responsible for its stability, usefulness and permanence. As a matter of fact not only our comfort but our very lives are dependent upon the care and skill of the engineer. With this in mind it seems strange that there are as yet no state statutes restricting the practice of engineering. Why have the engineers escaped while architects are controlled in Illinois, California and New Jersey? The only answer which seems satisfactory is politics. If that is so then the engineer must be prepared for practice statutes in the near future similar to those governing architects in the States mentioned as it has been held time and again that such statutes do not contravene the Fourteenth Amendment of the United States Constitution. Many of you are probably aware of the attempt to put through such a statute in this State a few years ago.

City or town laws or ordinances taxing the practice of engineering in the city or town are frequent and common. The taking out of these licenses, as they are usually called, is often required not only in the place where the engineer has his office or offices but in the place where he is doing the construction work. As failure to comply with these statutes often involve a fine, if nothing worse, they should be looked after. In this connection it might not be out of place to suggest that those fortunate enough to have large incomes must now look out for the Federal income tax.

These brief considerations call for the following recommendations:

First: Practising engineers and would-be engineers should annually ascertain whether any State laws have been passed governing their profession, and if such laws have been passed, carefully follow each and every provision.

Second: Ascertain whether or not there is any municipal or town license tax on the engineering profession where they have offices or jobs.

Third: Before taking employment in another State to ascertain whether there are any State restrictions governing non-resident engineers.

Fourth: Since many engineers practise their profession under the form of partnership, while the partnership named uses some designation or name other than the names of the partners, in such cases they should take care to file the proper certificates as required by law.

Fifth: If the form for doing business is a corporation be sure and comply with the requirements of the State in which you are incorporated, and also with the requirements for foreign corporations in those States where construction work is undertaken. This is very important as otherwise you may do work and have no remedy to secure your pay if the same is refused and especially if your fees are under the $3,000 limit of the Federal Court.

Let us now briefly take up the subject of the engineer's employment. It can be sub-divided as, Employment by individuals, by corporations, by municipal corporations, and by a State or the United States. No matter who your employer is, be sure and always have the full and complete terms of your employment in writing. Then don't forget that such a written contract excludes in a court of law all consideration of preliminary negotiations or agreements or documents pertaining thereto prior to the written contract and not made a part of the contract. Compliance with this simple suggestion will prevent many disputes, and also troubles with the Statute of Frauds.

Know whom you are dealing with, and the extent of their authority if they are acting for others, and beware of conditional contracts, or as it might better be stated, contracts with conditional payment.

Naturally there are less complications in employment by individuals than in the other classes I have fixed. It will probably be possible for me to dismiss this class with merely a warning to look out for agents, committees of organizations, and irresponsible real estate dealers and operators.

When considering employment by a corporation it must be noted that a corporation is a legal person endowed with life by a charter. That charter rules and governs its powers and hence the corporation cannot do anything not specified or essentially implied by the charter. It is therefore possible though not probable that some corporations might not have the power to employ an engineer, and if one were employed and refused compensation, he could not recover at law for such services. The chief difficulty, however, in dealing with a corporation is to know whether or not the officer with whom you are dealing has the power to act or has been granted authority by the Board of Directors to employ an engineer. Generally speaking the employment by the President or the General Manager of a corporation is sufficient to charge the corporation with the employment so that you are assured that the plea of "no authority" will not be used against you, but the only safeguard is a resolution of the Board of Directors. One civil engineer had a case of this that he will never forget. In seeking work one day he went to the office of a large Bridge Corporation and asked for the President. That officer being out, he met the Secretary and Treasurer and also the Vice-President and stated that he would like to make plans for them for the bridge which they were expecting to construct over the Hudson River from New York to New Jersey. These officers said, "We are the men who carry on the business here and you can talk with us." The engineer's ability and experience was discussed and he was then given a pamphlet containing the dimensions, width of span, clear opening, height and other details of the bridge. Said pamphlet further showed that before any construction could be begun or permitted, the consent and approval of the Commissioners appointed by the States of New York and New Jersey would have to be obtained; also that the consent was required to be obtained from the federal government before any structure could be placed over the river; and it further disclosed the fact that the bridge corporation had an engineer and an assistant. The engineer spent six weeks upon his work and then submitted to the Vice-President and Secretary and Treasurer an elevation, plans and general strain sheets, which were looked over and pronounced very good. As there had been some misunderstanding regarding the clear height, the engineer left the first plans with the officers and started to draw further plans. The latter were completed in about two weeks' time and upon their being shown to the officers they stated that that was what they want-

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ed. Subsequently these officers told the engineer that they would submit his plans to the Board of Directors, and still later the Secretary and Treasurer told him that the Board had accepted his plans. Later on the engineer prepared an article for publication containing a description of the bridge, together with lithographs of the drawings for the bridge. This article was published by the corporation and stated that the plans prepared by the engineer would be used in the construction of the bridge. The Vice-President and Secretary and Treasurer invited the engineer to be present on the ceremony of breaking ground for the bridge, and being present he was introduced to various persons as the engineer or architect whose plans had been accepted. The engineer's plans were not thereafter used, and upon suit brought to recover for the preparation of the same it was held by the trial court and also by the Appellate Court that there could be no recovery for the plans as furnished or for the labor and time devoted to their preparation. This decision was reached upon the ground that from all that appeared in the evidence the persons who talked with the engineer respecting the plans, and the engineer himself, did not contemplate either the one to accept or the other to furnish by binding or agreement any plans; but that the officers were willing and invited the engineer to submit a plan which might or might not be adopted, depending entirely upon certain contingencies; and also upon the further ground that under such circumstances the Vice-President and Secretary and Treasurer could not have the power to accept any plan or create a legal obligation against the defendant in connection therewith. The contingencies which the Court considered were that the work was of such national importance that no plan would or could be accepted until it had passed the scrutiny of the Board of Directors of the defendant corporation and received the approval of the State and national authorities.

When we think of the dealings of engineers with municipal corporations and their departments we usually think of the salaried engineers protected by the civil service. While there are many interesting questions that constantly arise in regard to the civil service as regards grading, salaries, etc., yet they are not important enough to dwell upon in this paper, especially as they are dependent upon the construction of special statutes. We are more interested with the consulting engineer in practice who is called upon to take charge of special or important work for the municipality. Early in my connection with municipal cases I made the recommendation which later experience has shown should be a subject for a desk card, "Never do any work for a public corporation without first consulting expert legal advice." That sounds as though there might be a great deal of personal interest involved but it is probably the best advice I shall give you in this paper. Let me tell you about an extreme case, which involved an architect, but the same principles would govern a contract of services for an engineer. In one of the New York City contracts a provision is found as follows: "The architect shall on or before the first day of November, 1904, furnish a set of preliminary studies and specifications, together with an estimate of the cost of said building or structure. If the said preliminary drawings and specifications and estimates are not satisfactory to and approved by the Commissioner, then the architect shall and will revise and correct the same so as to conform to the suggestions and criticisms and requirements of the commissioner, and so that the estimated cost, including the architect's fees, of the cost and service and inspection shall be well within the sum of $48,000, the funds available for said building or structure."

It has been judicially determined that under such a clause it was not necessary that the preliminary drawings, specifications and estimate should be within the sum mentioned and it was intimated that if the estimated cost, including architect's fees, ran above that figure it would become a question for the jury to determine whether or not there had been a substantial performance of the contract by the architect. In the latest case, however, the same Court held that the architect was bound to furnish not only preliminary plans, drawings and specifications, which, with the architect's compensation, should be within the limit of cost of $48,000, but that the final drawings, which must include the suggestions and criticisms of the commissioner, should also be within the $48,000. The facts in the case were that the architect drew preliminary plans and specifications, the estimated cost of which, including his fees, was within the $48,000. These preliminary plans were not approved by the commissioner, but were revised and changed to meet his approval. These revisions were in the nature of betterments and the commissioner was advised that by making said changes he was increasing the cost. The architect was told to proceed with the work and follow his requirements and suggestions, which he did. When the final plans and specifications were approved by the commissioner, the architect estimated the cost as about $58,000, including his fees. The engineering staff of the commissioner thereafter suggested further changes, and while the commissioner did not finally determine to make the same, yet it resulted in putting off the advertisement for bids upon the plans for almost a year, during which time prices advanced. The plans were finally advertised but the lowest bid received was $66,000, exclusive of architect's fees. Thereafter the work was abandoned. Upon suit to recover for the services performed, the Court held that the architect was not entitled to anything, upon the ground that the contract clearly indicated that the amount appropriated for the building was not to be exceeded, and there being no larger appropriation, the amount of the appropriation bound both the plaintiff and the commissioner, or, in other words, that since the architect obeyed the instructions and requirements of the commissioner, as required by the contract, and yet failed to keep the cost within the amount appropriated, he thereby lost his compensation for his work.

Another clause of the same contract provided for the payment of one per cent. upon the completion of the drawings and specifications called for by the clause hereinbefore set forth, and it was contended that the architect was at least entitled to that one per cent. The Court held to the contrary, on the ground that the approved revised plans did not come within the limit of cost of $48,000.

This case and others seem for the present to establish a new rule of law in such employment, that where an architect contracts to furnish plans not to exceed a certain cost and the bids being largely in excess of said cost so that the plans are abandoned, the architect loses his right to any compensation for the work done. This seems an exceedingly harsh and unfair requirement to put upon an architect, especially when one notes the range of prices bid by the contractors upon the same plans pursuant to the ordinary advertisements for bids. How can a municipality conscientiously and fairly ask an architect to plan a building and make his remuneration dependent upon his following not only the requirements and suggestions of the official in charge, but also refuse to give him any credit in case there is delay in advertising for bids, especially when the contractors' bids will vary thirty per cent. on the same plans? However, the Courts have so held and it behooves architects and engineers to take it into consideration in this class of work.

In such employment the engineer to be assured of pay for his services must know that each and every provision and requirement regarding appropriation and employment have been complied with by the legal and proper officials or official. The Board can usually only act by action at Board meeting. Hence employment by Commissioner of Health in this city would not be valid since it is the Board of Health which must act. It might be said that the engineers and other professional men are the subjects of exception from the many requirements of the Charter of The City of New York regarding written contracts, and competitive bidding for their jobs. There are even instances where the Court has said that after plans and specifications have been prepared for a large municipal building, and where no express provision was made for a supervising or superintending architect or engineer that it might be considered as one of the things essential to carrying in effect the main purpose of the appropriation for the erection, furnishing and equipment of the building and hence the employment of such superintending architect or engineer was proper and could be paid from the general appropriation. It may be noted that it is now general in most of our State statutes to find a clause which shows that the appropriation for the engineering work must include the engineer's charges. Employments of this nature are usually largely political and I hardly need warn you that you should at all times get any earned money as soon as possible since the change of officials or new administrations cause many unpaid bills to be forever unpaid. As a brief summary the following might be suggested:

1. Know there is an appropriation for your work.
2. Know that the official employing has the power to employ.
3. Keep the cost of the work within the appropriation.
4. Get your money as soon as you can.

Employment by the State involves all the troubles suggested in employment by municipalities and also the fact that in many States you are absolutely at the mercy of the contracting official because there is no way in which you can compel payment for your services save through legislative consent to sue the State which road is usually blocked if you have troubles with the official which require such action. This statement is of course only applicable to those states like Pennsylvania, etc., which have no Court or Board of Claims.

It seems almost incredible that in this our "haven of hope" for the poor and oppressed, State officials are permitted to rob, cheat and plunder those who contract with the State or its departments with practically no redress. I know of instances where the Czar of Russia as pictured to us in history could not have done a better job than has been practiced by some of these officials. Beware of this kind of employment, it is dangerous.

In employment by the United States while you have to exercise much the same care that you do in taking employment from municipalities, yet you have a chance for your compensation in the Court of Claims.

Accounting Department

Conducted by Harry M. Smith*
Certified Public Accountant.

The following is a continuation of the article published in the last issue.

Balance Sheet Liabilities

(1) CAPITAL STOCK—

Capital stock of a corporation is firstly authorized by its charter or constitution; secondly, created by resolution of the board of directors; and thirdly, issued to the stockholders either for cash or for other valuable consideration. This statement, however, requires modification. According to the law of most of the United States, and of Great Britain, capital stock cannot be issued except for value; but this legal difficulty is avoided by issuing it in accordance with a contract in the body of which is contained a statement as to value conformable to the stock or other securities to be issued, and the excess of this value over that of the actual tangible assets acquired is often euphemistically entitled goodwill. In effect, as is shown by the market quotations for such stocks, they have frequently been issued at a discount, i. e., to a par value in excess of the true value of the concern.

While this fiction has so far maintained its legal sanction, it still remains doubtful how far an issue of stock for a cash consideration clearly less than its par value is legal, or whether if so issued the purchaser or holder is not liable to pay up the whole of the discount, at any rate on liquidation of the corporation. This is the law in England—with the exception that is now legal for a corporation to pay a reasonable commission for services in placing its stock—and it is also the statute law of some of the United States, notably New York. Discount on stock would therefore either be an asset of the corporation recoverable from some person or persons and not chargeable to profit and loss, or the liability on the stock would be the amount actually paid for it. Premiums on stocks issued may be a source of surplus to the corporation eventually, because they are cash received in excess of the authorized capital which must be maintained intact, but they are not profit on operations and should not therefore be credited as such to Income, although they may be applied to make good depreciation or losses do not arise out of the ordinary business of the corporation.

In the case of both discounts (if permissible) and premiums, the proper view would seem to be that the stock is sold for whatever it will fetch, and that any discount or premium should be considered as a deduction from or addition to the par value of the stock on the face of the balance sheet.

Capital Stock Without Par Value.

This view is reflected in a law recently passed by the Legislature of the State of New York which permits incorporation with shares having no specific par value, the shares of stock representing shares in the surplus of assets over liabilities and being sold from time to time for whatever they will bring. Objection has frequently been taken to the absence of a par value for the reason that it might provide opportunities for improper manipulation by unscrupulous promoters. In reply to this, it may be urged that in other States where a fixed par value is maintained and where the law provides that it must be paid in cash, there are many known legal methods of evading these provisions by means of contracts, and unscrupulous promoters find no difficulty in carrying out their schemes while the legitimate plans of more scrupulous people are hampered. It is difficult to see how the absence of a par value can give more opportunities for fraud than are available under existing laws, and the power to incorporate on this plan would enable shares in an undertaking of uncertain or speculative value to be issued or sold on their merits.

As long as stock has a fixed par value it is better, theoretically, to treat premiums thereon as receipts on capital account, but no serious objection can be raised to crediting them to profit and loss surplus, preferably under a separate subheading.

Treasury Stock.

An important question arises as to the treatment of stock of a corporation held in its own treasury. Many corporations still treat this as an investment asset, either under a special division of the balance sheet or among the current assets.

The Interstate Commerce Commission in its railway balance sheet makes the same requirements, but in the steamship balance sheet, more recently issued, requires that the correct accounting methods detailed below be followed. A little consideration will show that such a practice is entirely erroneous and misleading, and moreover, that it also raises difficult questions of valuation. The capital stock represents the manner in which its property and assets are distributed among those who constitute the corporation. If one of these owners disposes of his share to the corporation, he withdraws therefrom, taking with him what he considers his fair proportion of the asset value, and leaving the rest to be divided among the remaining owners. Assuming that the seller get full value, the value remaining to the other is neither more nor less in fact than it was before, although if the stock is actually worth more or less than its par value, there will be an apparent profit or loss on the transaction; the effect of which may be thus illustrated: A corporation has a capital stock of $1,000,000, divided into 10,000 shares of $100 each, and represented by assets of equal value. The holders of 1,000 shares withdraw, i. e., sell ther shares to the company at the book value, which in this case is par. The stock is thereby reduced to 9,000 shares, i. e., $900,000, and the assets are similarly reduced by the payment of $100,000 to $900,000. There is clearly no reason whatever for pretending that there are still 10,000 shareholders and assets of $1,000,000, when as a matter of fact there are only 9,000 with assets of $900,000, and the position of these 9,000 is entirely unchanged.

A similar result would appear if the capital stock was originally only $800,000, with assets of $1,000,000, and therefore a surplus of $200,000. If holders of 800 shares withdraw, taking $100,000 of cash or other assets, i. e., the book value of the stock, the position of the remaining stockholders is unaltered.

If more or less than the book value of the withdrawn shares is paid, then the remaining shareholders have on paper sustained a loss or realized a profit; but whether or no this is a real loss or profit depends upon the intrinsit value rather than the book value of the shares. This paper or book profit or loss is lightly charged or credited to Profit and Loss Account as a special item. There is no possible variation from this result in the most complicated cases; but lawyers have devised clever legal fictions for pretending that the stock which either has not in effect come into existence, or has in effect gone out of existence, still exists. These are mainly designed to evade the law that capital stock cannot be issued at a discount; and while in many cases no doubt they are harmless in their results, in others they are made use of for improper purposes. As an instance of such a device, it is found that on the purchase of an undertaking by a corporation a large block of stock is issued to the vendor, of which a proportion is returned to the corporation as a gift. In effect this stock so returned acts as a reduction of the purchase money, and both cost of property and capital stock should be correspondingly reduced. In practice, the stock having been apparently legally issued at par, subject to the very doubtful possibility of any attack being made on the validity of the contract, can now, when it returns to the corporation, be sold at a discount below par, and if, as may well happen, the stock has been taken onto the books at a figure well below par, the ultimate effect is that, in spite of the law to the contrary, the stock is sold by the corporation at a discount and the discount charged to cost of property, which is thus considerably inflated. The effect of this device is clearly the sale of the stock at a discount, but this is concealed from stockholders, and it would undoubtedly be much better if the stock had no par value and were issued at whatever price it would fetch on the market, without the necessity for such juggling as now frequently takes place. The accounting rule should be that all stock in possession of the corporation which issues it, should be deducted from the liability shown on the balance sheet so as to truly set forth the number of shares in the undertaking which have really been issued to and remain in the hands of the public at the date of the balance sheet.

Another objection to treating such stock as an asset is that, not being held as necessary for the purpose of the activities of the company, it cannot be treated as a permanent asset and maintained at cost, but must be written down to market value, if below cost, thus in effect unduly reducing the surplus if the value is below par, or unduly increasing it if the value is above par.

As a matter of convenience small amounts of such stock are carried as marketable investments when the same are held temporarily; even this practice is open to criticism as lending itself to a use of the funds of a corporation for influencing the market in its own stock, which is not one of the purposes for which it is permitted to exist. A desirable amendment to the existing law would be one that would make it illegal for a corporation to own its own stock, a provision which is already in force under the rules of the New York Stock Exchange.

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Effective Interest Rate of Bonds.

Premium or discount on bonds is a deduction from or addition to the nominal rate of interest which the bond carries; that is to say, there is a rate known as the true or effective rate at which any corporation can place its bonds at par; if it elects to place them at any other rate the bonds will sell at a premium or discount as the case may be; but the effective rate remains the same and this effective rate is the proper charge to Income account. Hence the premium or discount should theoretically be spread over the term of the bonds, and the annual installment thereof credited or charged to Income account each year.

It should be remembered that the effective rate must be applied not to the par value but to the cash value at time of issue of the bonds; e. g., for bonds issued at 90 the effective rate will be calculated on $900 for each $1,000 bond, and not on $1,000.

Annual Income Charges.

Having ascertained this true or effective rate on the basis of the terms of issue, it is still frequently a difficult matter to determine the charge that should be made to Income account under the conditions which may actually exist in the future.

If an issue of bonds be made for a fixed term of years at a certain nominal rate of interest, with provision for the redemption of a specified amount each year at fixed prices, it is a comparatively simple matter to determine the present value of all the repayments, and thence—by an inspection of annuity tables—the equivalent theoretical interest rate on the basis of the fixed present value and term.

Varying Conditions Affecting Annual Charge.

In accounting for the charge to income where the effective interest method is adopted, these cases must be considered:

(a) Bonds issued at a discount and redeemable at par. When the bonds are first issued the full par value would be credited to the liability account, while the difference between this full value and the cash received would be charged to a discount on bonds account. The full effective rate of interest would be charged to income account, while so much of it as represents the nominal interest would be credited to Interest Accrued, and the balance to Bond Discount, thus gradually reducing this account over the life of the bonds.

(b) Bonds issued at a premium and redeemable at par. The conditions are exactly the reverse of case (a) Discount on Bonds account will become Premium on Bonds Account with a credit balance; the effective interest charge will be less than the actual, leaving a charge to Bond Premium Account in reduction of the balance on that account.

(c) Bonds issued at par, redeemable at a premium. This case is in substance identical with (a) but in practice the treatment is different, as there is neither discount nor premium at the date of issue. The charge to Income Account will exceed the interest accrued, and the difference will be credited to Bond Premium account and accumulated there until final redemption, all premiums paid on redeemed bonds being charged to this account.

(d) Bonds issued at a discount and redeemable at a premium. This combines cases (a) and (c). The excess of the effective rate will be credited to Premium and Discount Account, and will gradually convert the debt balance on that account into a credit sufficient to equal the amount of all premiums payable on final redemption.

In practice it is often found that bonds are purchased in the market at prices varying from, and generally less than, the specified redemption prices, and then transferred to the trustees of the sinking fund at the specified prices, and a saving thus effected which must be taken into account in determining the annual charge to income. Or, again, the redemption rates may be anticipated for a whole or part of the issue, and further disturbing factors thus introduced.

The saving on the purchase of bonds in the market at prices below those fixed for redemption may be dealt with in one or other of the following methods:

(1) Credit the amount to Income Account each year, thus finally disposing of it.

(2) Credit the amount to discount (or premium) on Bonds Account, thus eventually producing a surplus on this account, which would ultimately be transferred to Income Account.

Neither of these methods is theoretically accurate; but in view of the impossibility of determining what the market price will be in the future, theoretical accuracy is impossible.

The treatment in the case of anticipation of redemption dates is a more difficult matter, for, if carried out on at all a large scale and not accomplished by an equitable reduction on the redemption price, the effective interest rate will be materially increased. The only sound method would appear to be to recalculate the effective rate on the basis of the bonds still outstanding and the new redemption terms. If this is not done, there may be a considerable shortage to make up at the date of final redemption. This fact is frequently overlooked, although it should be recognized as an important factor, particularly in any refunding or redemption plan.

Methods of Determining Charge to Income.

There are various methods in use for determining the proper interest charge to be made to Income Account under the varying conditions that arise.

The first and most correct method which may be called the effective interest method, consists in charging to Income Account the effective interest rate calculated from the known conditions of issue upon the whole amount outstanding during the year, with an addition or deduction of an amount equal to the excess of deficit of the amount paid for redemption during the year as compared with the fixed amount provided. For instance, if the conditions of the issue provided that $100,000 of bonds be retired during the year at 105, and as a matter of fact they are purchased at 95, the true interest on the bonds bearing interest during the year would be reduced by $10,000, representing the saving on bonds retired during the year as compared with the price therefor assumed in determining the effective rate. The tendency of this method would probably be to increase gradually the annual charge to Income for interest and sinking fund until the limit price of redemption was reached; for, as the amount of bonds outstanding diminished, the market price might be expected to rise.

The second and more common method, which may be called the equal instalment method, is to ignore altogether the effective interest rate; to charge to Income Account each year the interest actually paid, together with a proportionate part, according to the whole term of issue, of the discount on issue or premium on redemption; Income Account being also credited with any savings made by purchase of bonds in the market.

A third method which may be called the bonds outstanding method, and which may safely be adopted where, by reason of complication in the terms of issue and redemption, it is difficult or impracticable to determine the true interest rate, is to distribute the discount or premium over the period in the proportion that the bonds outstanding for each year bear to the sum of the bonds outstanding for all years of the currency of the loan. Any saving made by the purchase of bonds in the market is credited to Income Account.

When a large accumulated surplus is available, the practice is frequently adopted of charging the whole discount on issue to Profit and Loss account, taking up any profit or loss on subsequent redemption at a discount or premium to the credit of Profit and Loss account as it arises, and leaving the nominal interest on the bonds actually outstanding each year as the only charge to Income account. A great objection to this practice is that thereby the true rate of interest paid on loans during their currency is entirely lost sight of; current fixed charges against earnings are understated; and the portion representing the discount is charged against surplus arising out of previous operations, instead of against income from current operations which should meet it. Any savings on bonds purchased in the market are a credit to Income account.

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